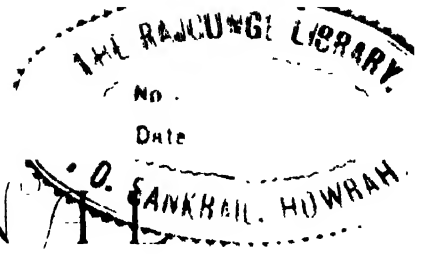


Gibb



NATION

AL

10. SANKHAIL, HOWRAH.



NCYCLOPEDIA

A DICTIONARY OF UNIVERSAL KNOWLEDGE.

By

WRITERS OF EMINENCE IN

LITERATURE, SCIENCE, AND ART

VOLUME X

LONDON.

WILLIAM MACKENZIE, 69 LUDGATE HILL, E.C.

EDINBURGH, AND GLASGOW

Elibron Classics series.

ISBN 0-543-88688-3 (paperback)

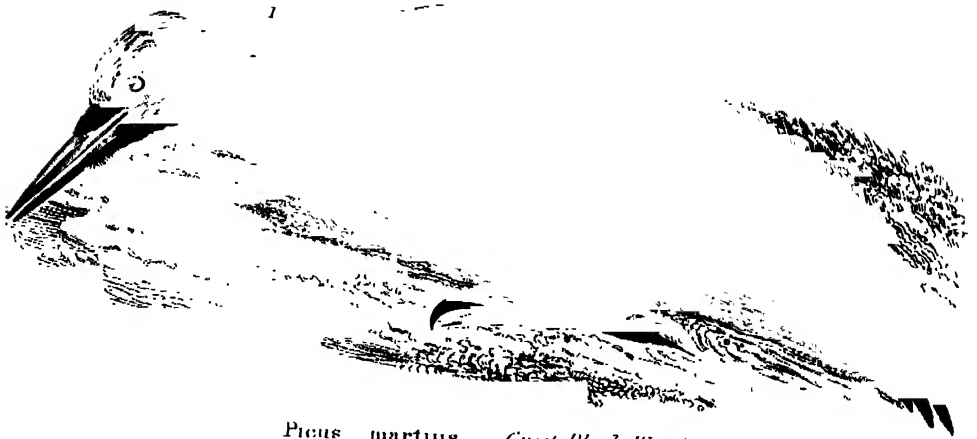
ISBN 0-543-88687-5 (hardcover)

This Elibron Classics Replica Edition is an unabridged facsimile
Of the edition published in 1875 by William Mackenzie, London.

Elibron and Elibron Classics are trademarks of
Adamant Media Corporation. All rights reserved.



Icthyophaga nuda. Wye-neck.

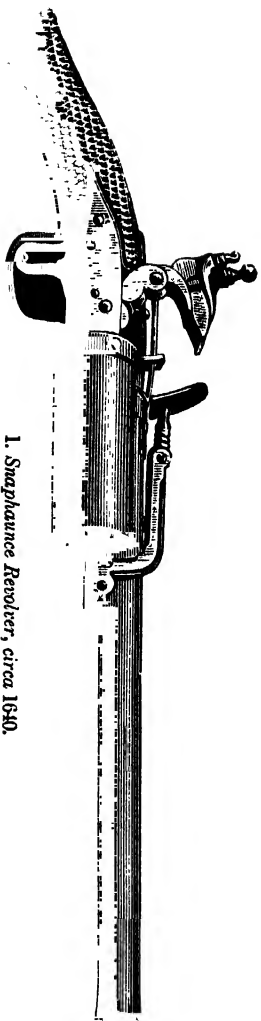


Picus martius. Great Black Woodpecker.



Picoides tridactylus. Southern three-toed Woodpecker.

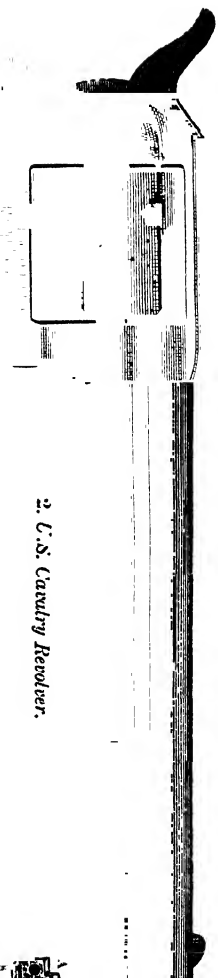
PISTOL.



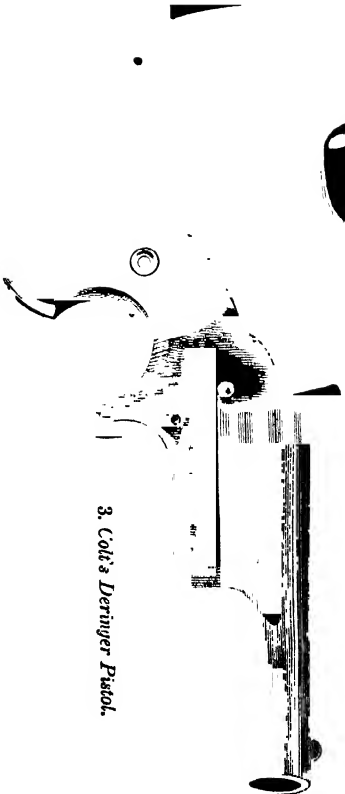
1. Snaphaunce Revolver, circa 1640.



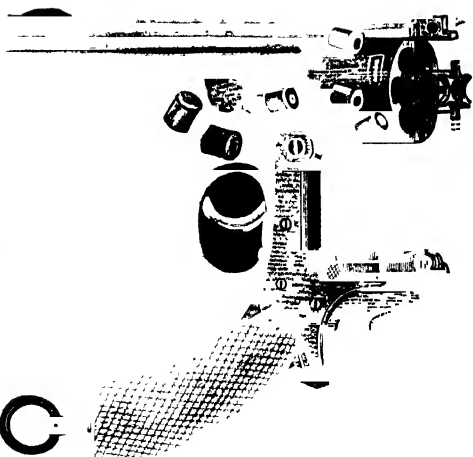
Full size Cartridge of Fig. 2.



2. U.S. Cavalry Revolver.



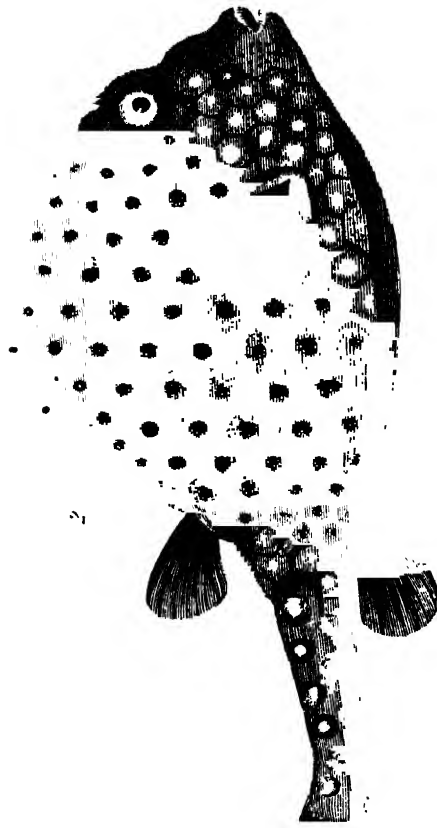
3. Colt's Derringer Pistol.



4. Self-extracting Revolver.



Balistes capriscus -- *Filefish*



Ostracion triquetrum -- *Citterfish*

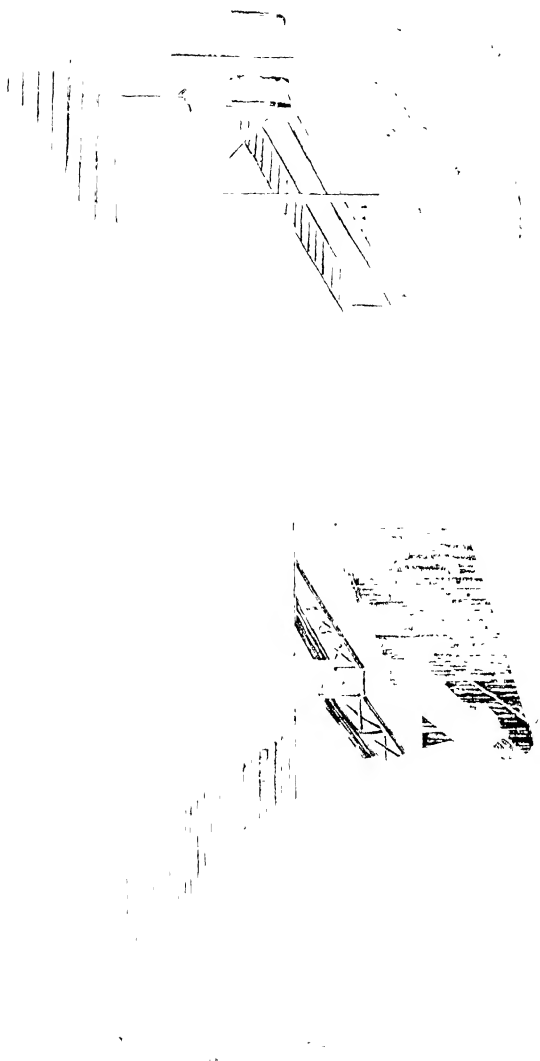


Diodon hystrix -- *Hedgehogfish*

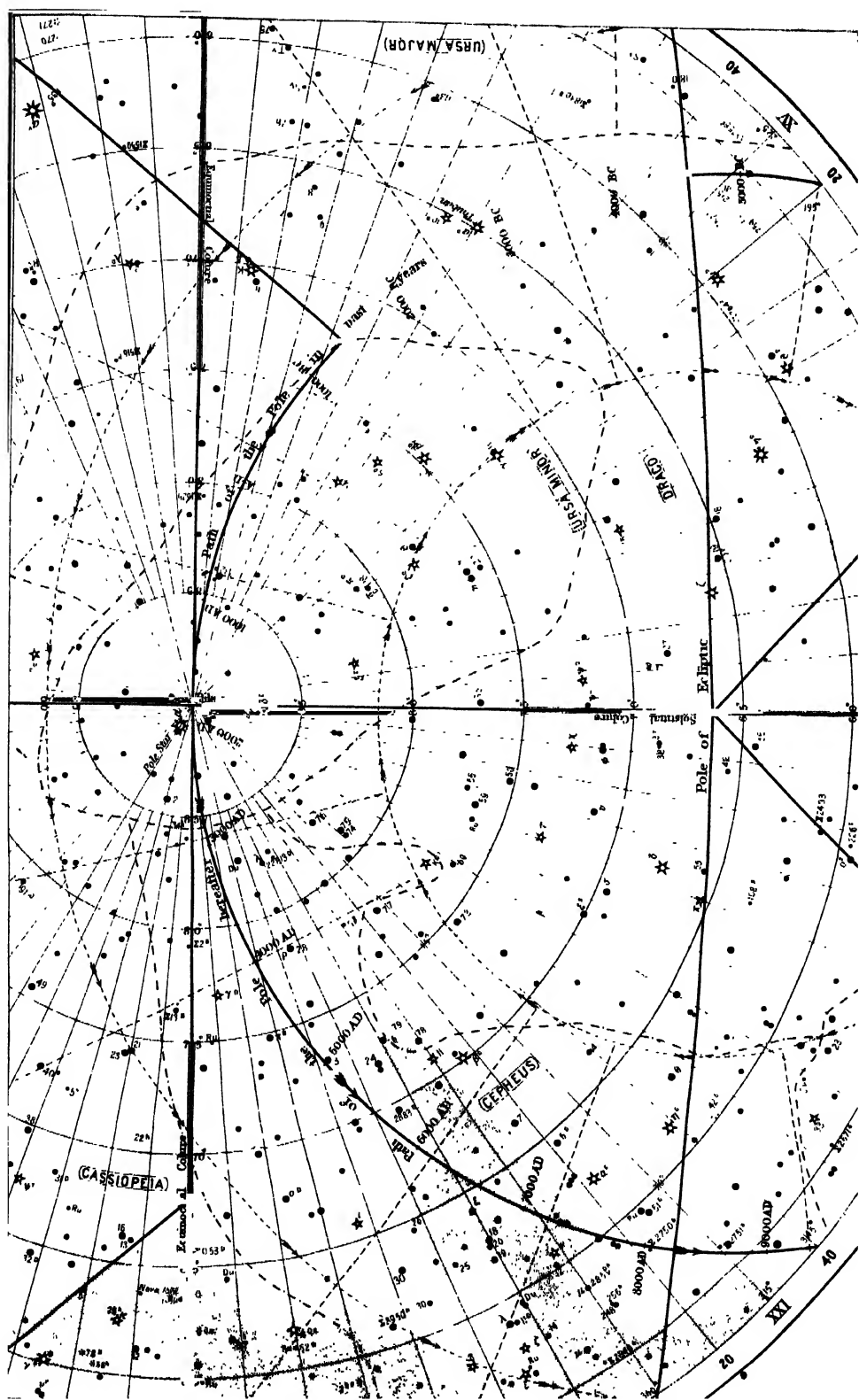


Orthogoriscus truncatus -- *Oblong Surgefish*

PLUMBAGO.



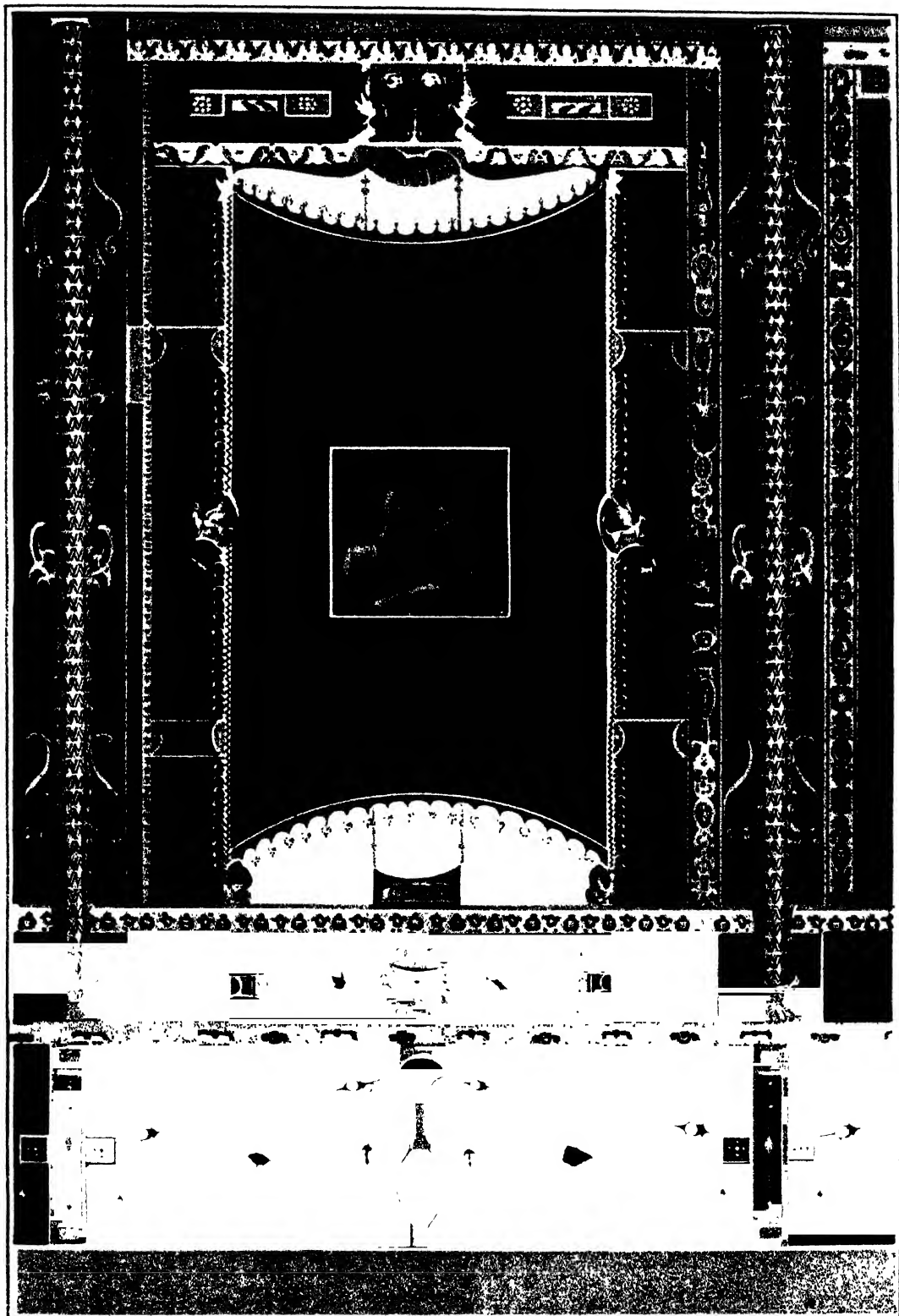
Interior of the Graptolite Mine of Batougol, in the Saianek Mountains, Eastern Siberia.

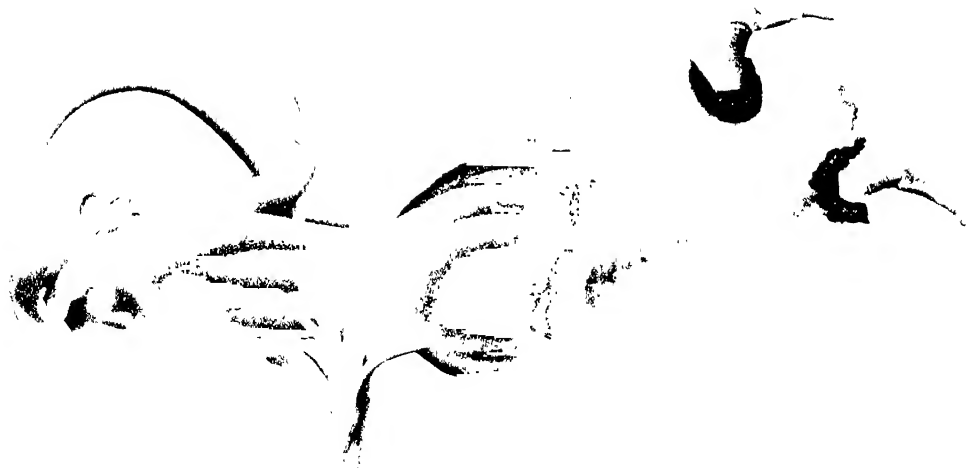


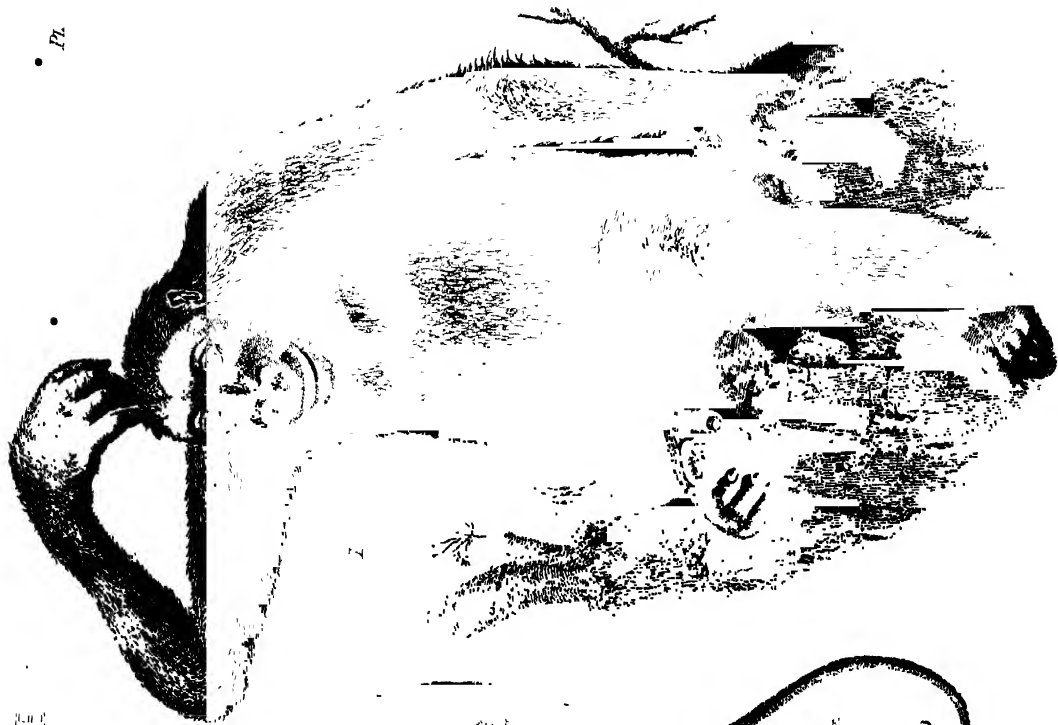
POMEGRANATE.
PUNICA GRANATUM



The Fruit-bearing Pomegranate







Trachypithecus varilla gorilla



Ateles paniscus Cuvier



Senopiopithecus nasalis. Proboscis Monkey



Myiotes seneculus Red Howler



Cebus fatuellus Brown Capuchin



Callithrix sciurea Squirrel Monkey



Haplate jacchus Common Marmoset

CORRECTIONS FOR PRESS.

- # 9 15 The first step towards ~~towards~~ the recognition by Britain of the ^{2/}
 16 independence of the South American colonies was the appointment of ^{1 2/}
 consuls to take charge of British commerce at their ports.)
- run. on 17 The intention of the government to adopt this measure was inti- ^{4 4/}
 sm. caps 18 mated by Canning in his answer to an invitation to send a repre- ^{a request/}
 19 sentative to a conference at Paris to aid Spain in adjusting the ^{13 1/}
 affairs 20 of the revolted countries of America. 'Commercial intercourse,' he ^{13 0}
 21 said, 'had grown up this between country and South America to ^{10 14/}
 22 such an extent as to require some direct protection by the establish- ²¹ =====
 23 ment of consuls. As to any further step to be taken by His Majesty
 # 10 24 towards the acknowledgment of the de facto governments of America, ^{ital/}
 25 the decision must depend upon various circumstances. But it appears ^{21 stet./}
 26 manifest to the British Government that if so large a portion of
 27 the globe should much longer remain without any recognized political ^{2 w.f.}
 no indentation 28 existence, the consequences of such a state of things must be most
 29 [injurious to the interests of all European nations. For these reasons ^{22 9}
 the British Government is decidedly of opinion, that the recognition ^{2 rom./}
 X 30 of such of the new states as have established de facto their separate ^{2 b. c./}
 political existence cannot be much longer delayed. [It was evident ^{16 new line}
 31 that the appointment of consuls to protect the interests of British
 caps 32 trade with South America would be followed by the recognition of the ^{14 0/}

EXPLANATIONS.

DELETIONS.

1. To delete a letter, strike it out, and make a delete mark ^{2/} on the margin.
2. To delete a word or sentence, draw a line through it, and make a delete mark ^{2/} on the margin.
3. When a word or sentence has been deleted, and it is afterwards decided to retain it, a line of dots should be placed under it, and the word "stet" (= let it stand) should be written on the margin.

CHANGES.

4. To change a letter, strike it out, and write the new letter on the margin.
5. To change a word, draw a line through it, and write the new word on the margin.
6. To change the type, one line is drawn under the word when italics are required; two for SMALL CAPITALS; and three for CAPITALS; and the respective abbreviations—"ital," "sm. caps," "caps," are written on the margin, according to the type required.
7. To change the type from capitals to ordinary small letters, underline it, and write "l. c." (lowercase) on the margin.
8. To change the type from italics to ordinary letters, underline it, and write "rom." (roman) on margin.
9. When a letter is of a different face from the others, strike it out, and write "w. f." (wrong fount) on the margin.

TRANPOSITIONS AND INSERTIONS.

10. To transpose letters or words, draw a line as above, and write "tr." (transpose) on the margin.
11. To re-arrange words, indicate the desired order by figures as above, and write "tr." (transpose) on the margin.
12. To insert letters, words, or sentences, make a mark [^] where the insertion is to be made, and write on the margin what is to be inserted.

PUNCTUATION.

13. Full stops are marked ⁰; commas, colons, hyphens, &c., ^{1/} ^{2/} ^{3/} ^{4/} ^{5/} ^{6/} ^{7/} ^{8/} ^{9/}; apostrophes and all reference marks and quotation marks when above the line, [^], [^], [^]; dashes, [—].

Note.—In deleting, inserting, and changing the above, the usual mode is adopted.

SPACING, &c.

14. To delete space, make the above mark at the place, and repeat it on the margin.
15. To insert space, make a mark of insertion, [^], at the place, and a space mark, ⁺, on the margin.
16. To make a new paragraph, make a mark as above, and write "new line" on the margin.
17. When a new paragraph has been wrongly made, make a mark as above, and write "run on" on the margin.
18. To indent a line, make a mark of insertion, [^], at the place, and a space mark, ⁺, on the margin.
19. When a line has been wrongly indented, make a mark as above, and write "no indentation" on margin.
20. When the spaces between the different words are unequal, make the above marks between the words.
21. When lines are twisted or bent, make the above marks, and repeat them on the margin.
22. When letters are sideways, or upside down, underline them, and make a mark on margin as above.
23. When a space is standing up and printing, underline it, and make a mark on margin as above ⁰.
24. Broken letters should be underlined, and "br. l." (broken letter), or a cross, written on the margin.

Note.—After every correction or remark written on the margin, an upright line should be drawn, as in the above corrections, to separate it from any other correction that may be on the same line.

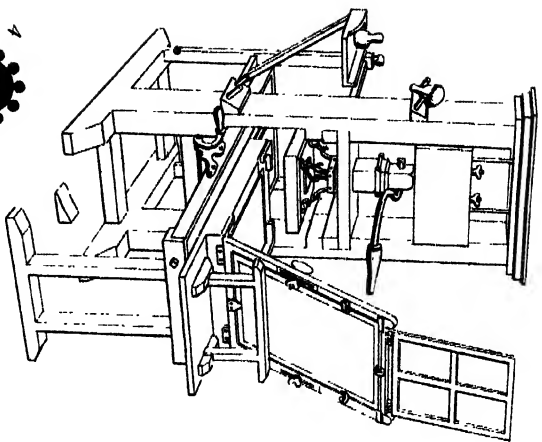
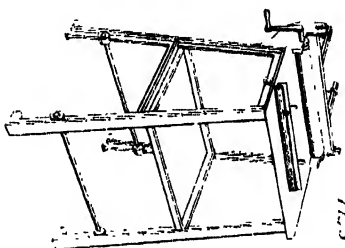
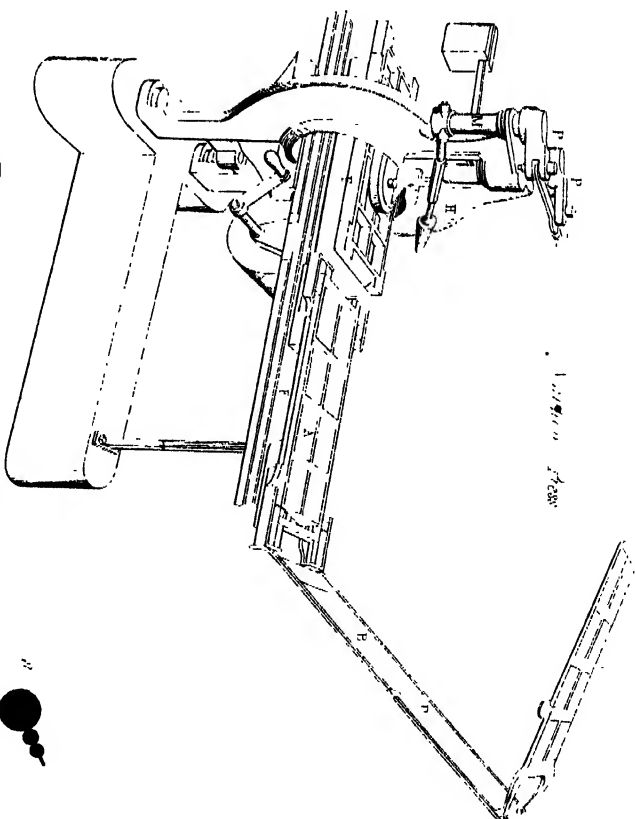
*Lawyer's Income Tax and Estate*

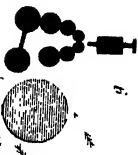
Fig. 3

[illegible]

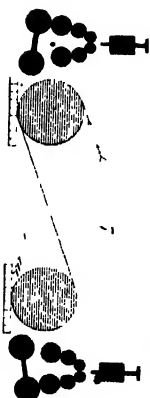
*Nickel-son, für
architect Type*



Richardson's
Commons Type



*Kenneth's simple
top and side on the street*



hucius double
ten both sides in the short



Madison and Barron's on Type



*Compassionate
and caring staff*



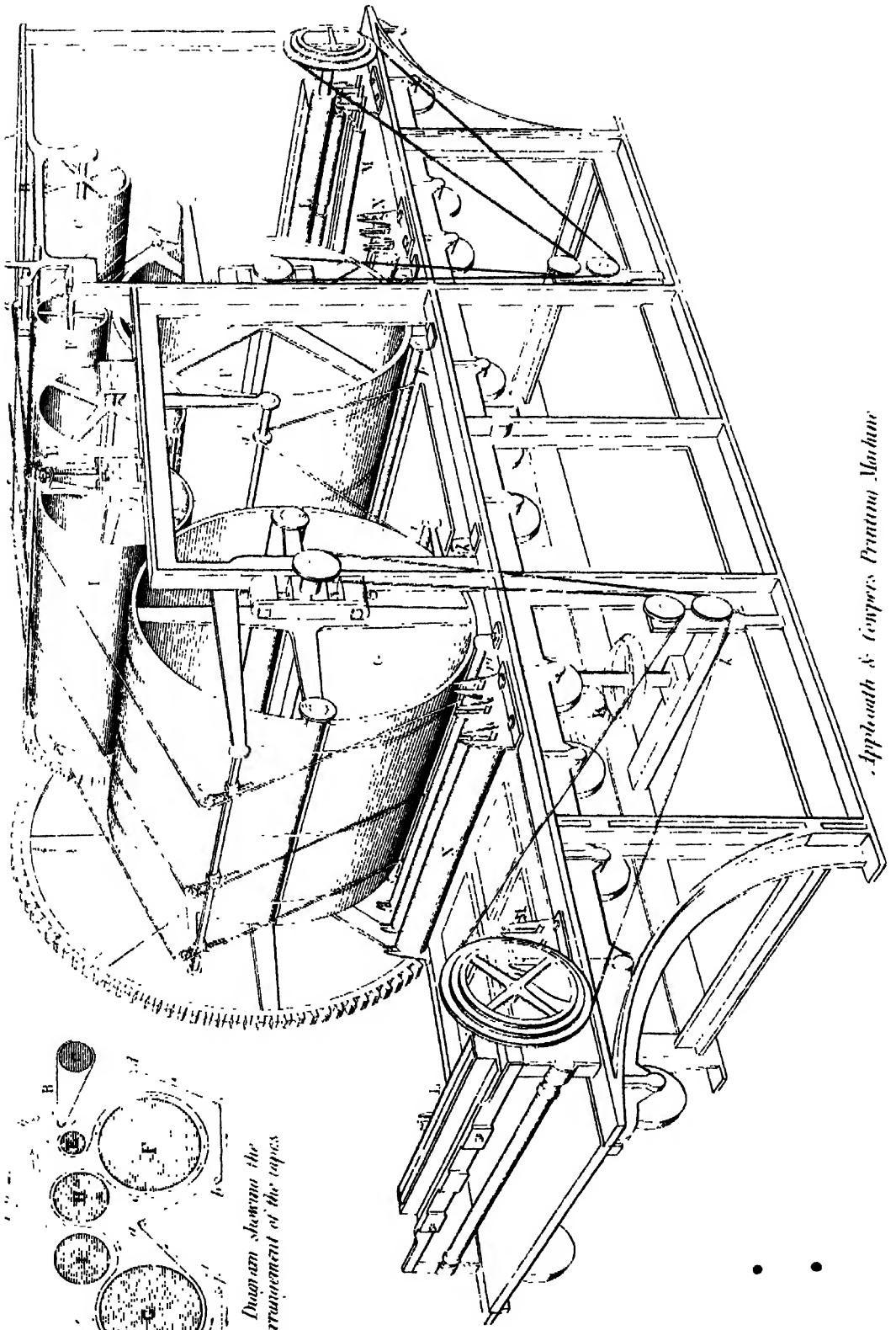
topper, double
top both sides of the sheet



Aplecanthi and Tupper's snail



Application and Computer Double



Applegate & Co's Patent Printing Machine

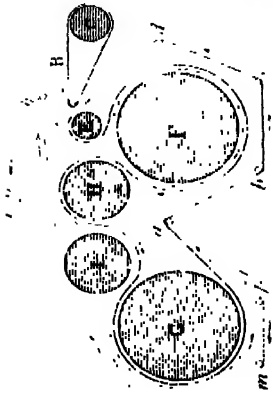
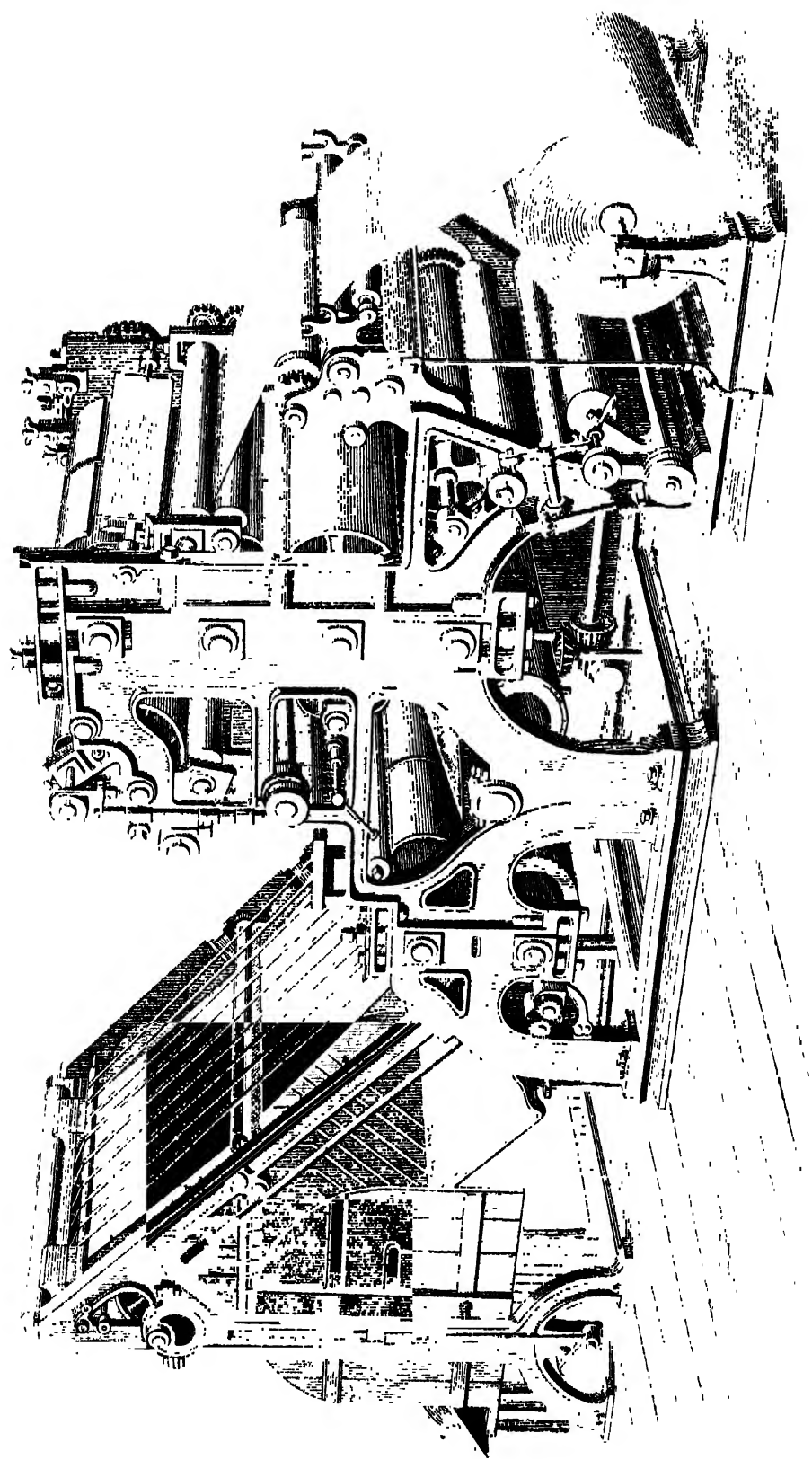
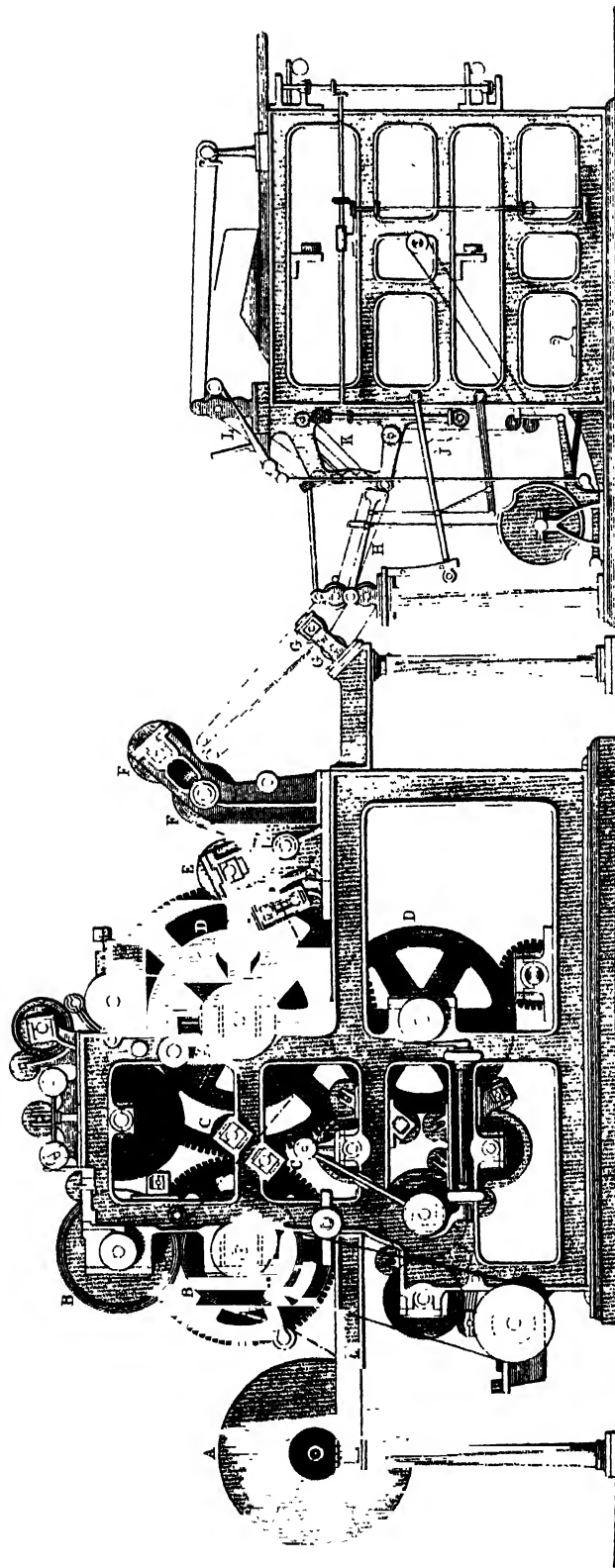


Diagram showing the arrangement of the types

PATENT
THE WALTER MACHINE

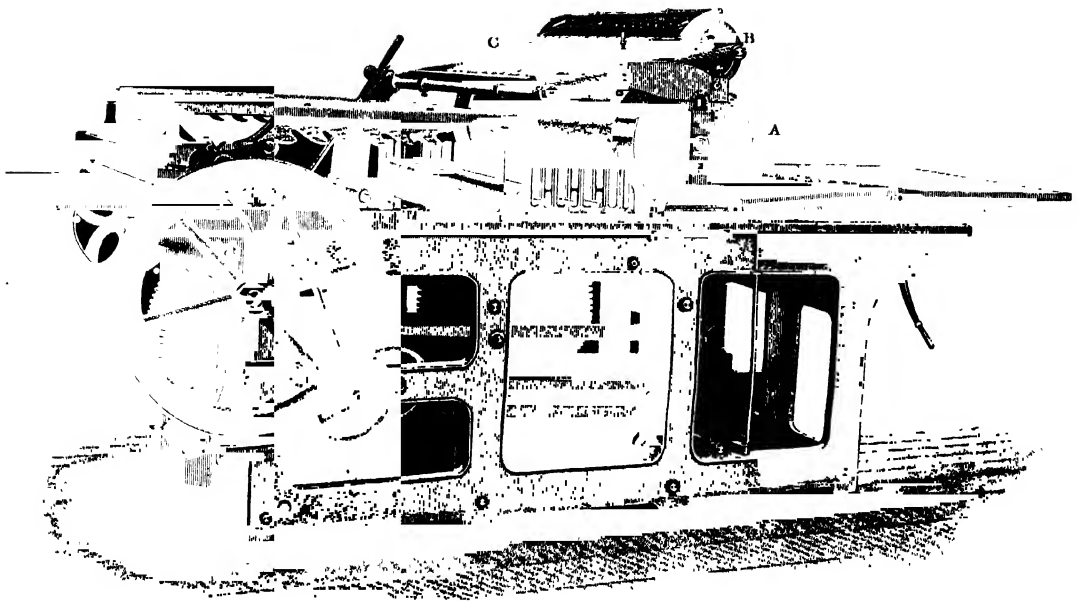


INGRAM ROTARY MACHINE FOR ILLUSTRATED NEWSPAPERS.

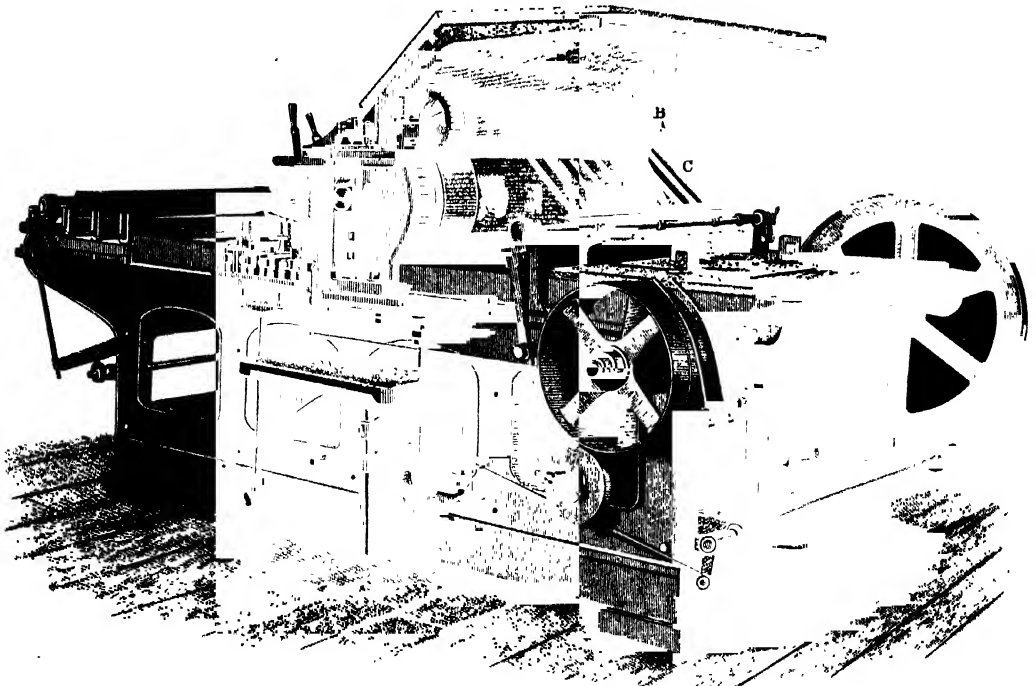


SIDE ELEVATION

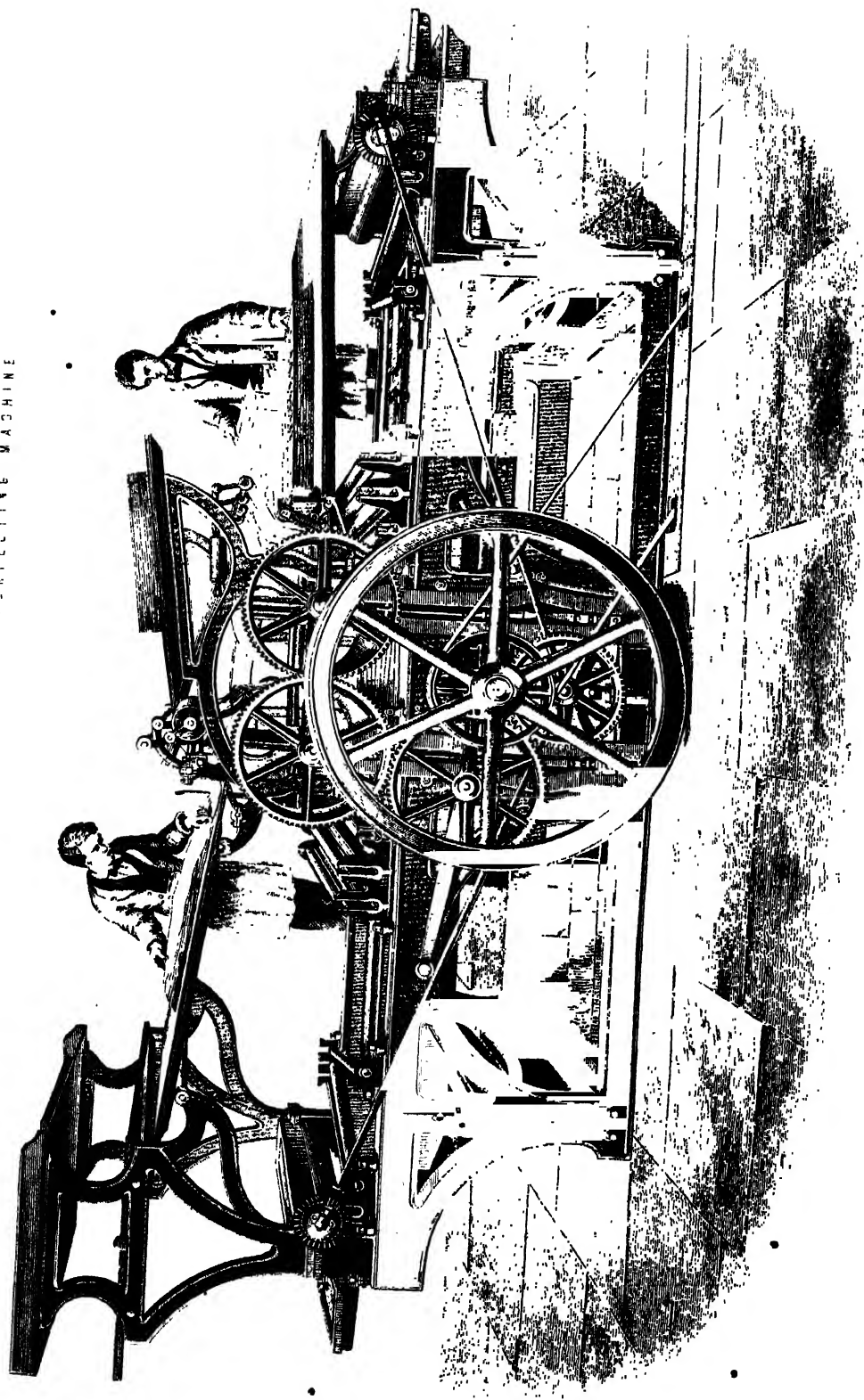
- A.* Roll of paper.
 - B B.* Type cylinder and impression cylinder for printing the matter in two.
 - D D.* Type and impression cylinders for the other form.
 - E E.* Cylinders with sun teeth and corresponding indentations to perforate the sheet of paper.
 - G G.* Smoothing rollers to break the paper at the lines perforated.
 - J and K.* Alternate running tapes.
 - L.* Roller to deliver sheets unrolled.
- The dotted line from *A* to *L* shows the course of the paper from the roll *A* to the folding machine.



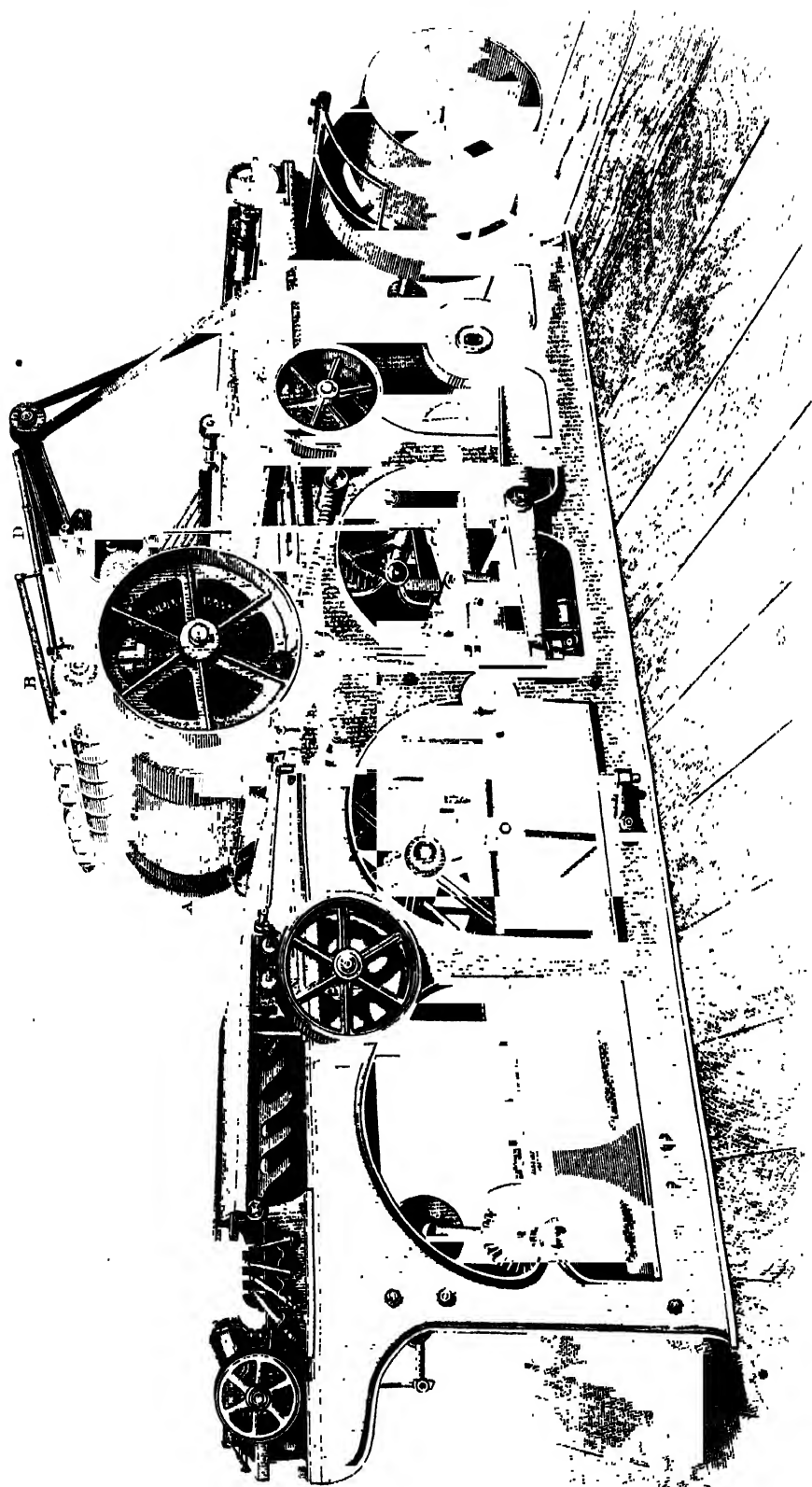
1. Wharfedale Single Cylinder Machine



2. Single Cylinder Machine top feeder



PRINTING



Boston, Braithwaite & Smith's Single Cylinder Printing Machine



Elephantus indicus. Indian Elephant.

FIELD GUN PROJECTILES OF THE CHIEF POWERS



German



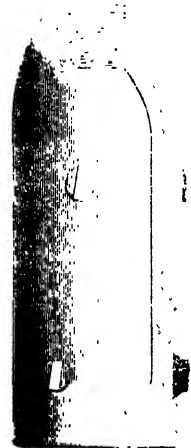
French



Russian

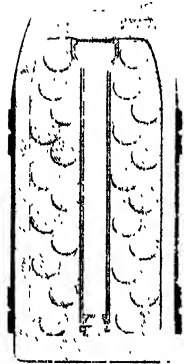


Italian

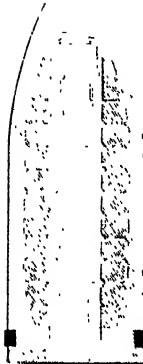


English

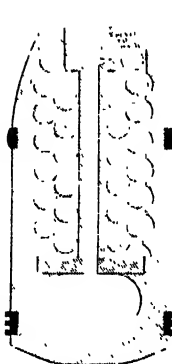
COMMON AND SEGMENT SHELL



German



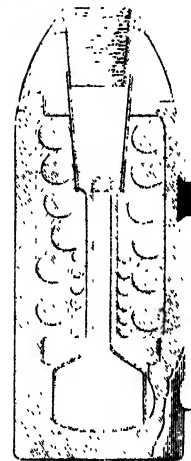
French
(Segment)



Russian



Italian



English

SHRAPNEL SHELL



German



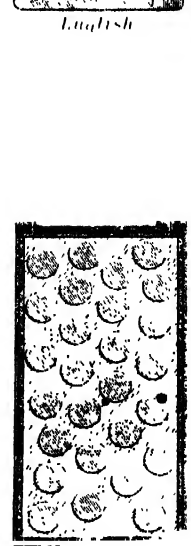
French



Russian



Italian



English

CASE SHOT

ARMOUR-PIERCING SHELLS — FUZES

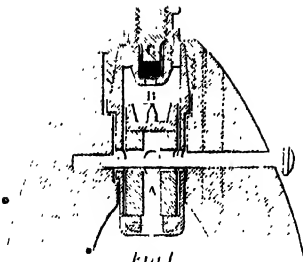


Fig 1
German Percussion Fuse

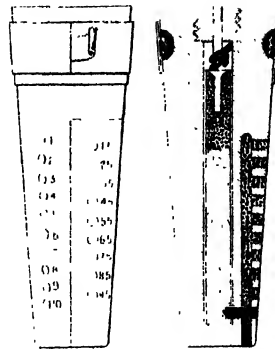


Fig 3
Boxer's Wood Time Fuse



Fig 4 German Time Fuse

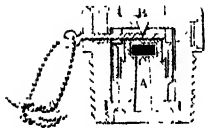


Fig 2 British Royal Laboratory
Percussion Fuse

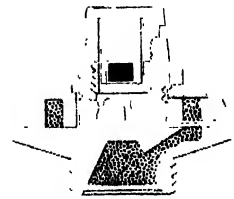


Fig 5 Section of above

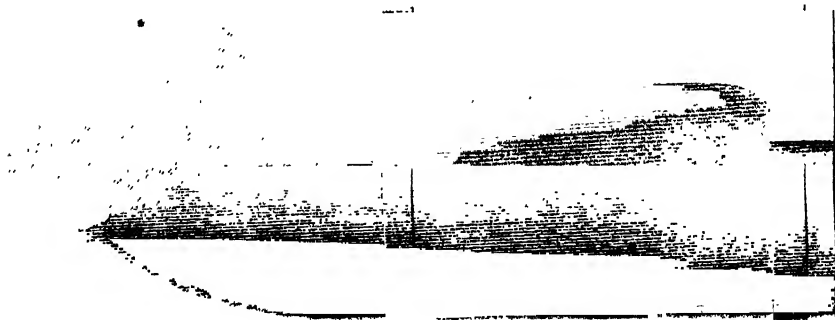


Fig 6 KRUPPS 71-TON GUN PROJECTILE
Length 14 m Diameter 15.7 m Weight 111 Pounds

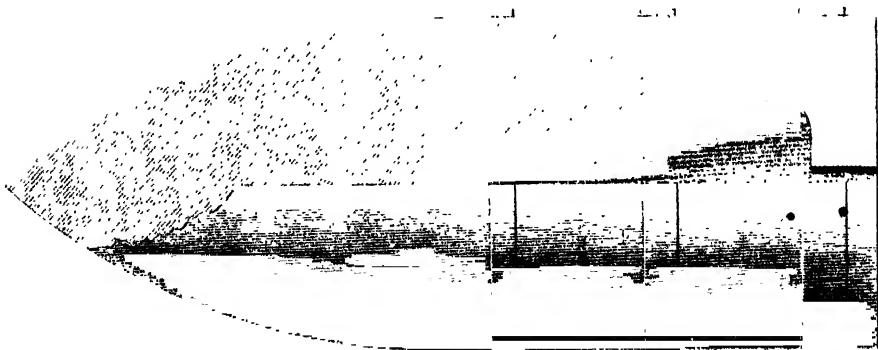


Fig 7 BRITISH 100-TON GUN PROJECTILE
Length 17.25 m Diameter 17.72 m Weight 245 Pounds

Fig. 1

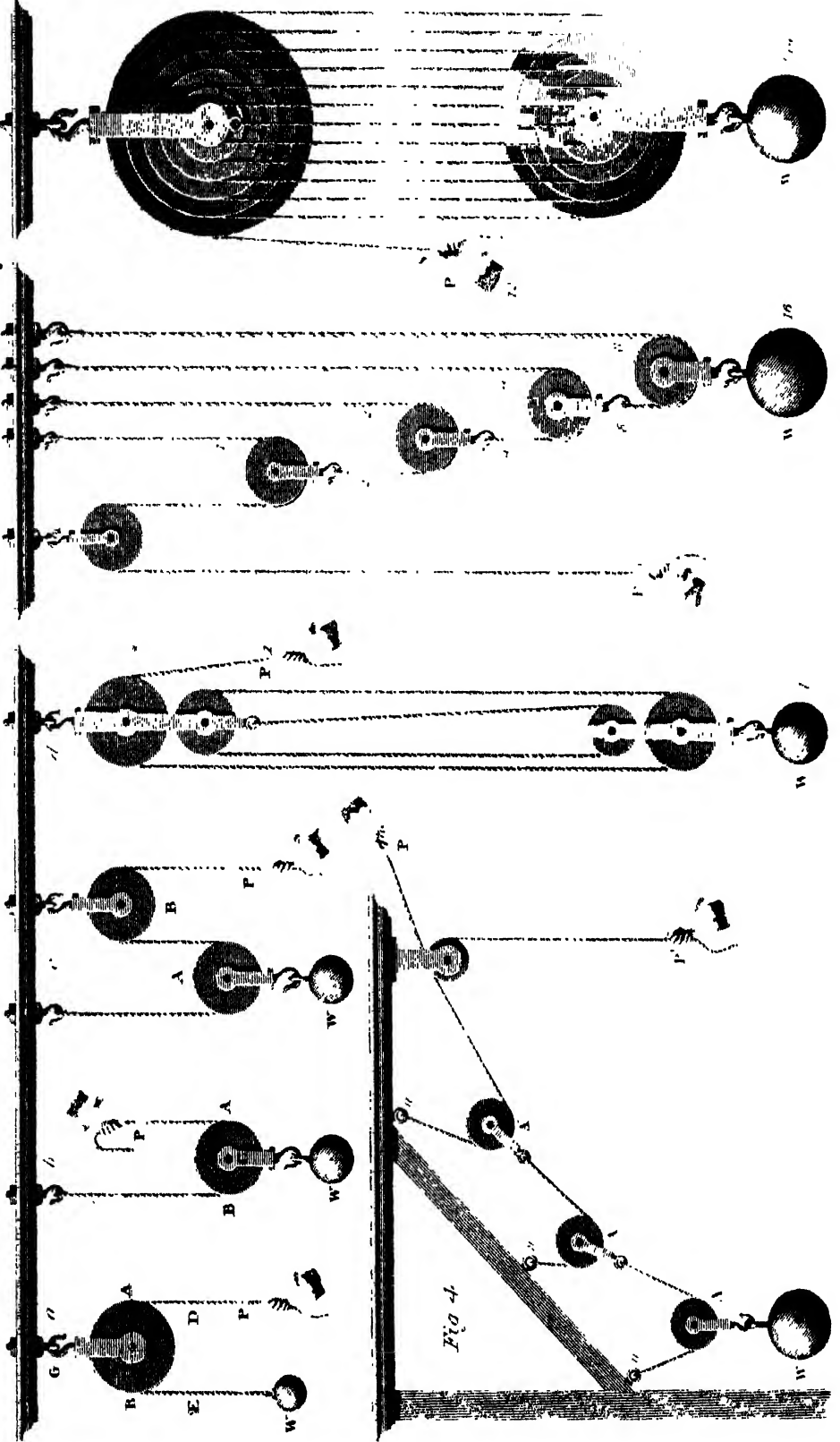


Fig. 2

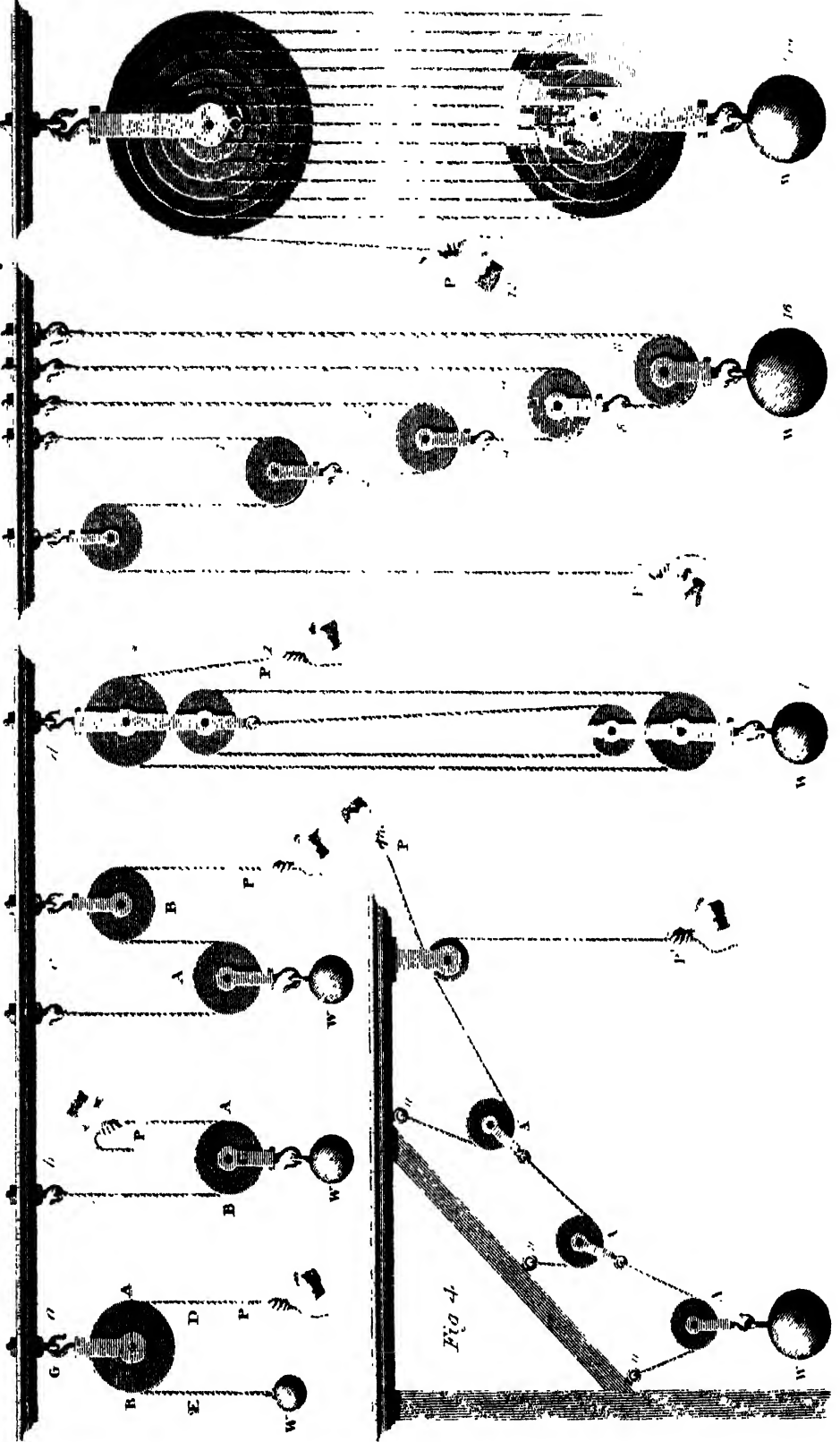


Fig. 3

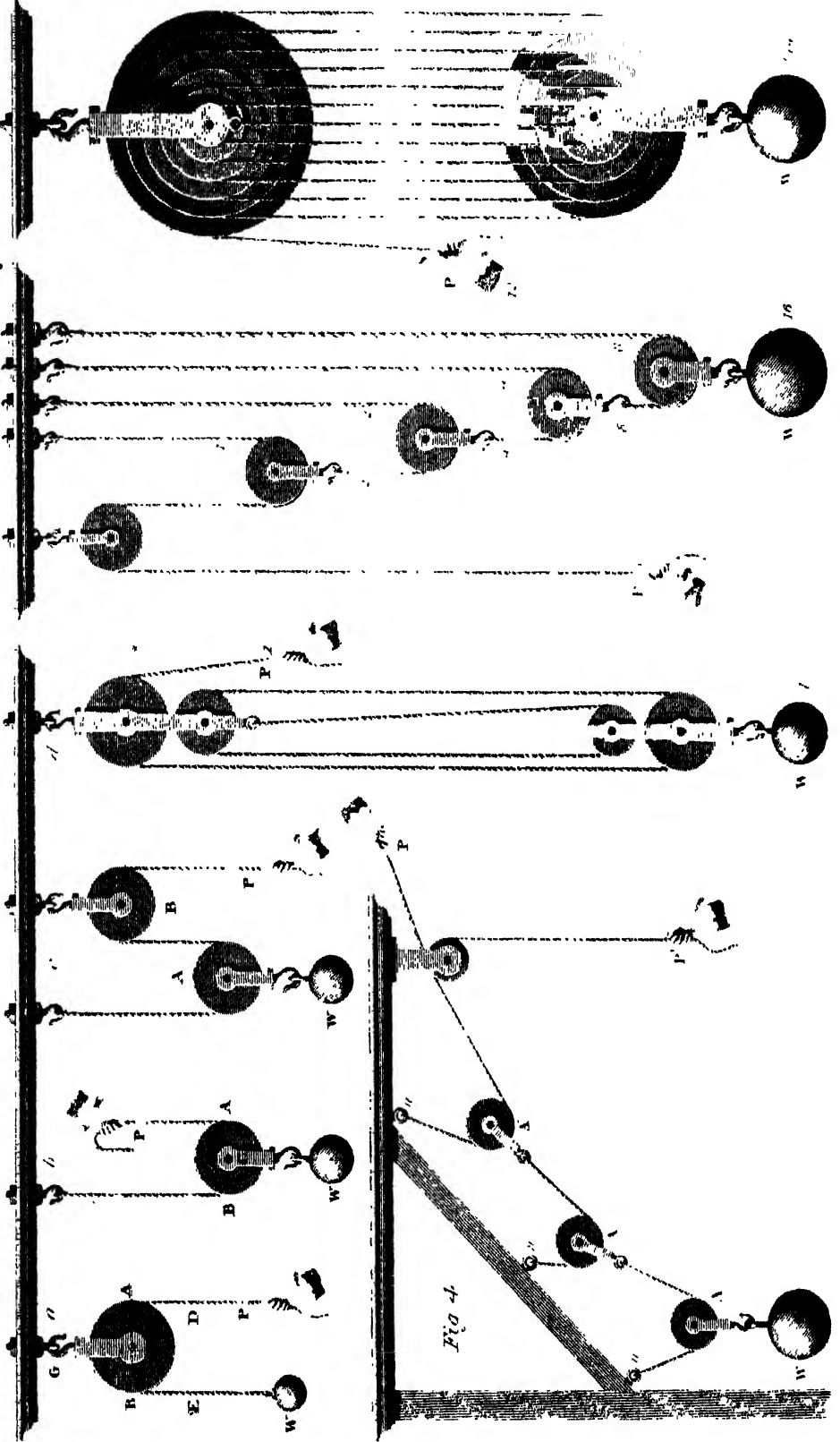
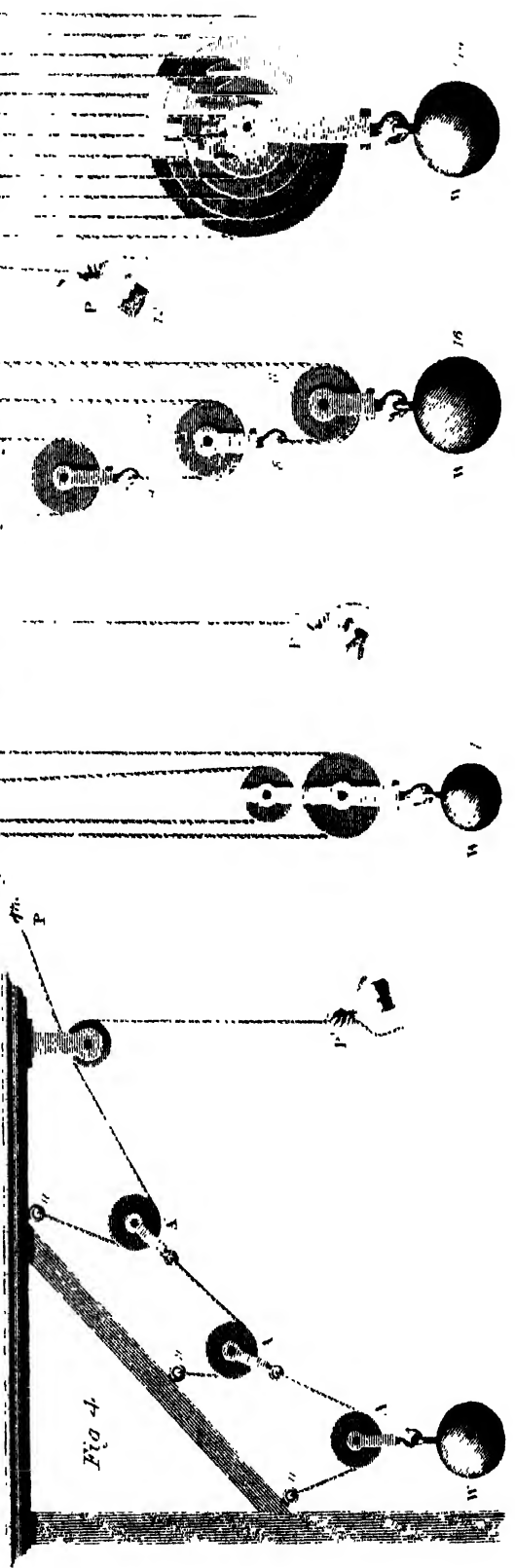
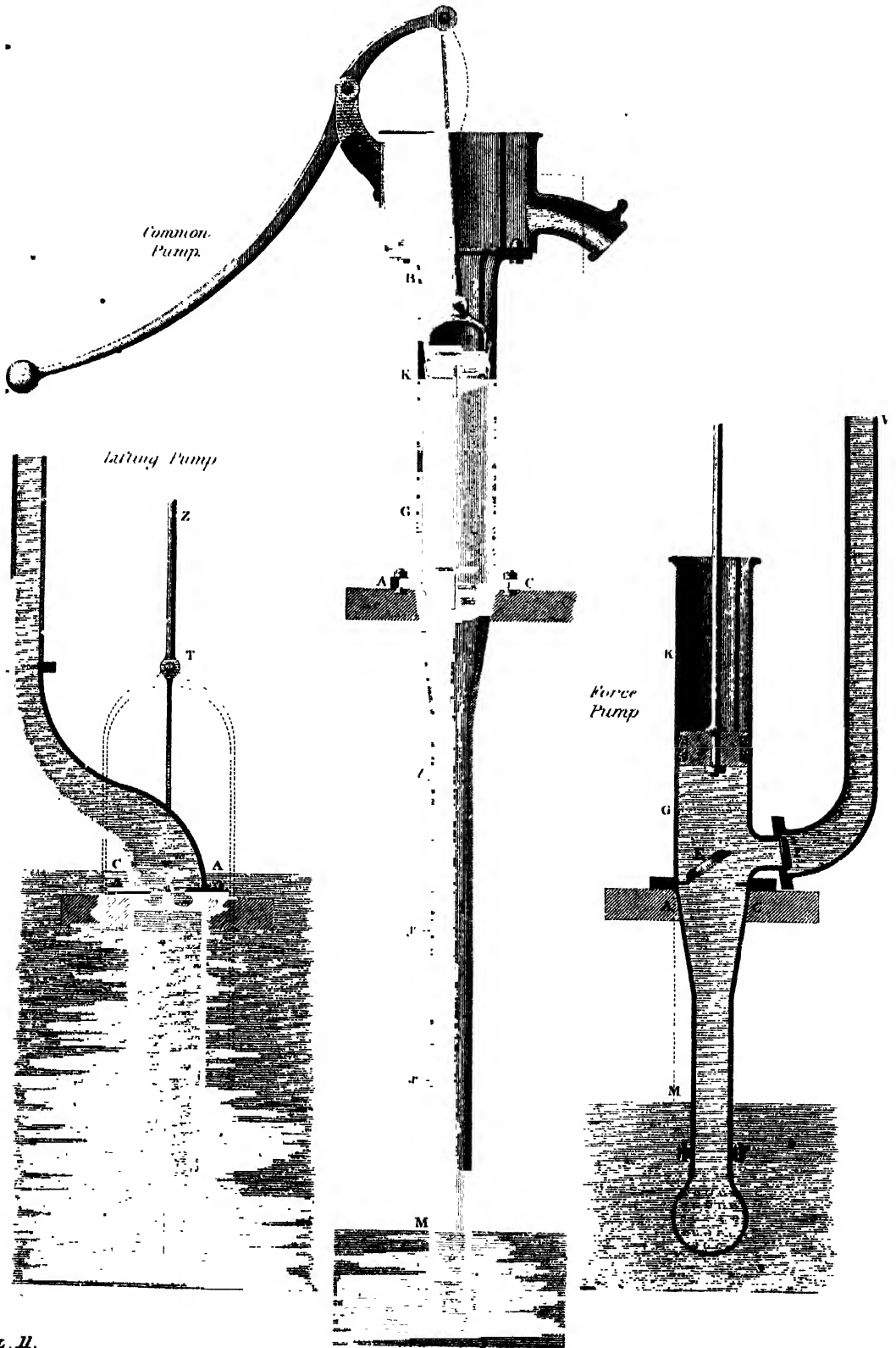


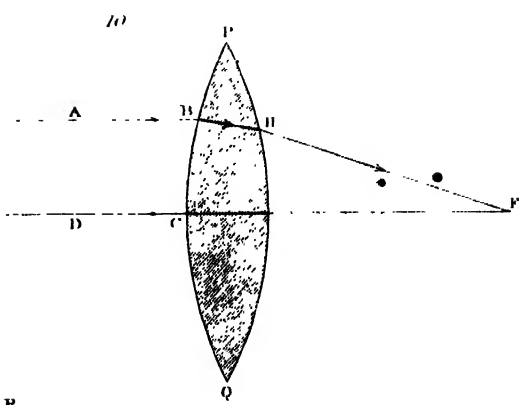
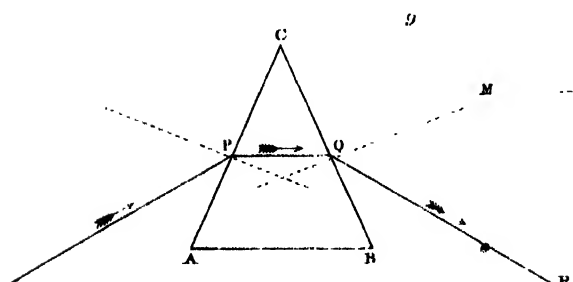
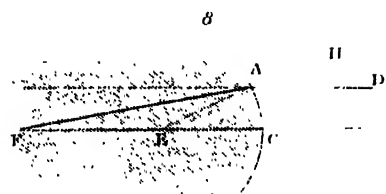
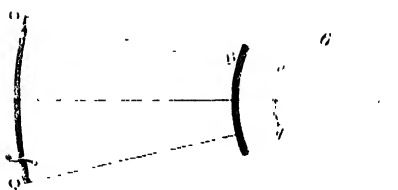
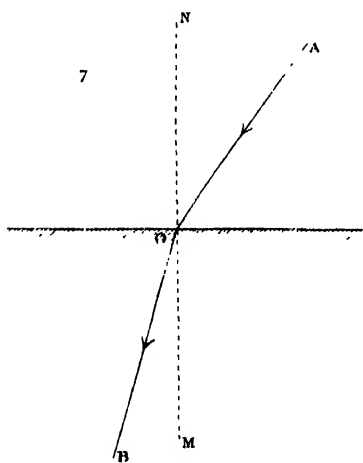
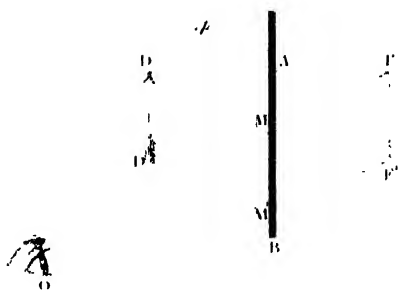
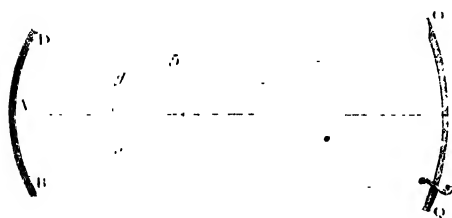
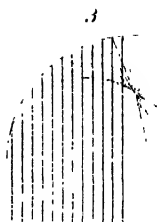
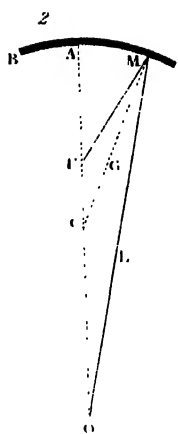
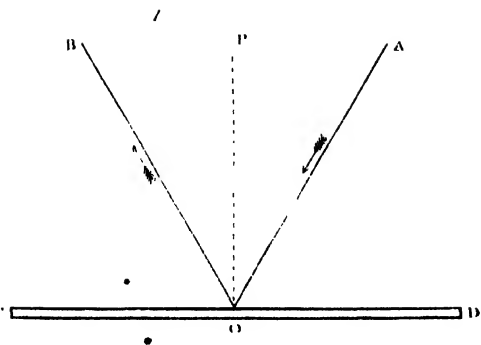
Fig. 4



P U M P .



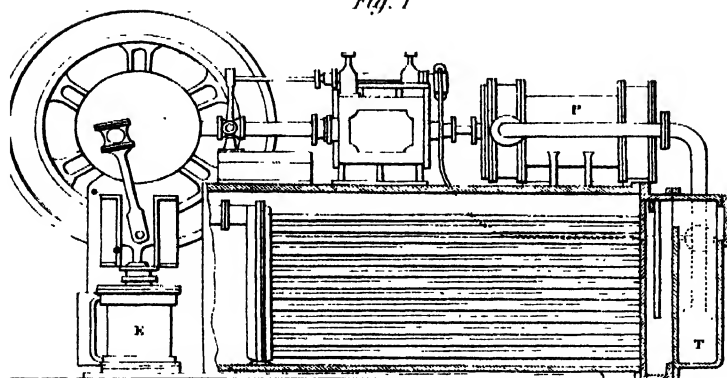
REFLECTION & REFRACTION.



REFRIGERATING MACHINERY.

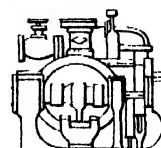
COLEMAN'S COMPRESSED-AIR APPARATUS

Fig. 1



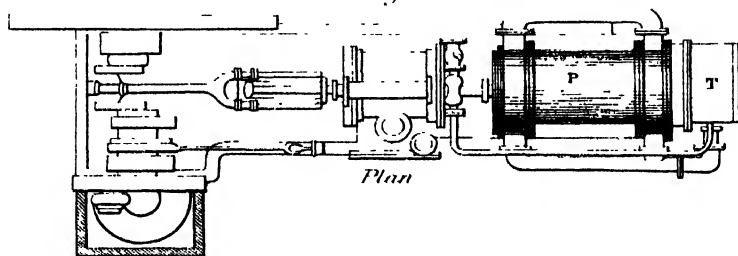
Side Elevation

Fig. 2



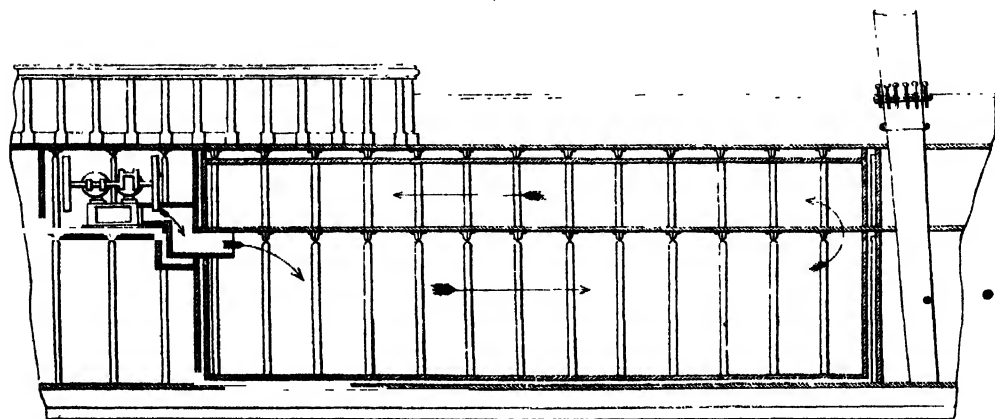
End Elevation

Fig. 3



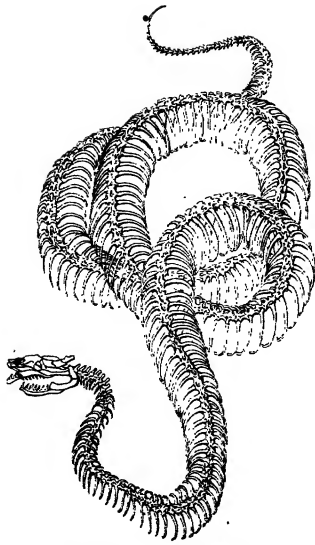
Plan

Fig. 4.



Longitudinal Section of Ship.

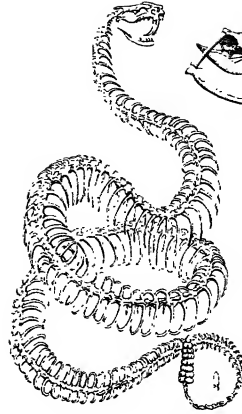
REPTILES.



1 *Python molurus* Rat Snake



1a



2 *Crotalus durissus* Rattle Snake



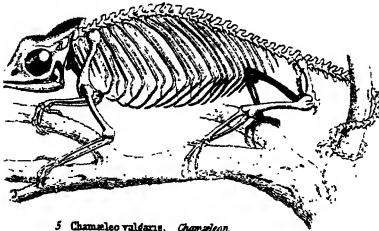
2a



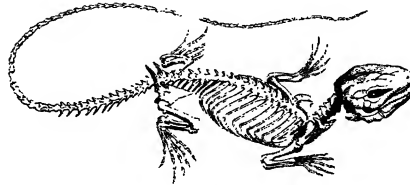
3 *Boa constrictor* Hind leg



4 *Boa constrictor* Hind leg



5 *Chamaeleo vulgaris* Chameleon



6 *Ligano tuberculata* Lizard



7 *Scincus officinalis* Skink



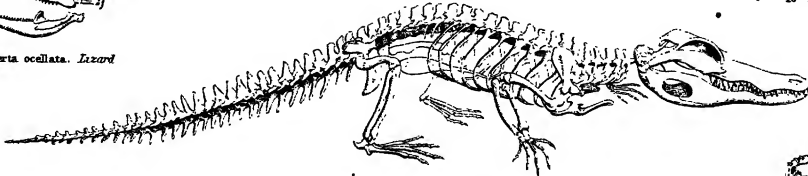
8 *Lacerta ocellata* Lizard



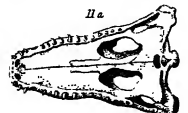
9 *Amphisbena alba*



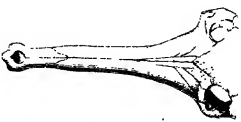
10 *Draco volans*



11 *Alligator lucius* Alligator



11a



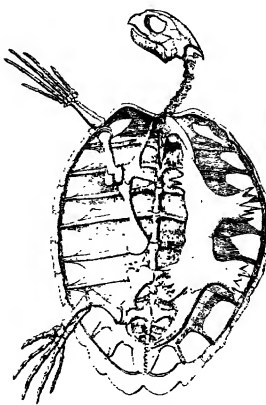
12 *Gavialis gangeticus* Gharial



12a



13 *Crocodilus vulgaris* Crocodile



14 *Thalassochelys*



14a

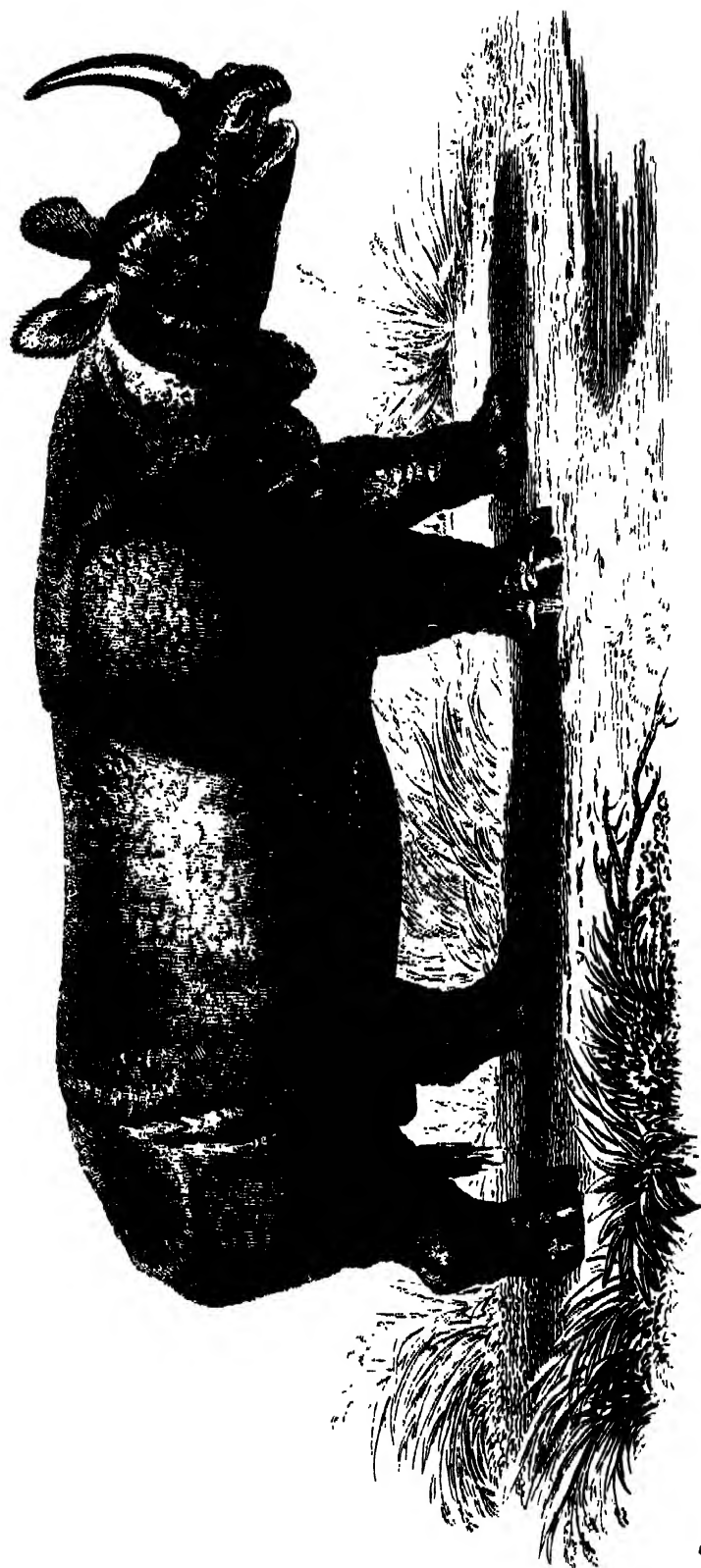


15 *Trionyx*



16 *Emys expansa*

R
H
I
N
O
C
E
R
O
S



Rhinoceros unicornis. Indian Rhinoceros.

RICINUS COMMUNIS.

CASTOR-OIL LANT

OR PALMA CHRISTI



D



Myoxus avellanarius — Dormouse



Sciuropterus subraus,
Greater Flying Squirrel



Marmota marmota, Alpine Marmot



Castor fiber — Beaver



Mus rattus.—Black Rat.



Myodes lemmus.—Lemming.



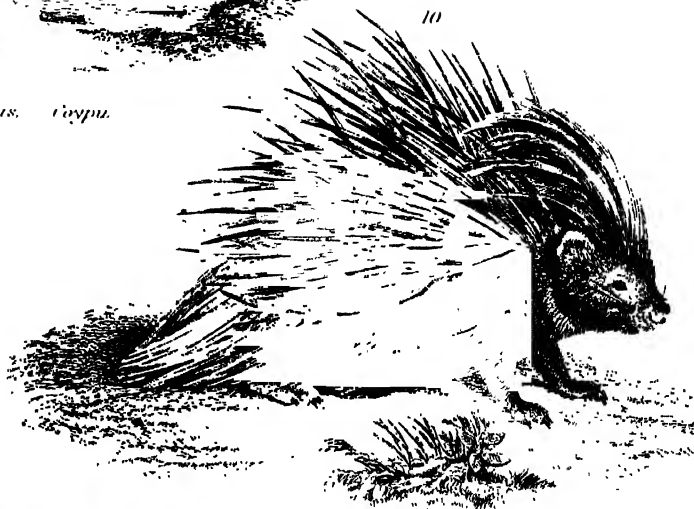
Lepus capensis.—Cape Jumping Hare.



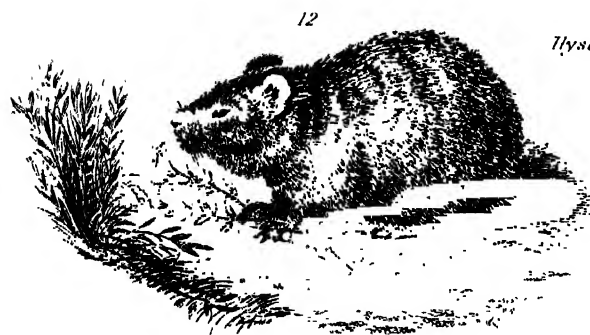
Dipus aegyptius.—Egyptian Jerboa.



Myopotamus capensis. Capu.



Erethizon cristata. Common Porcupine



Lepus pusillus. Gophertail



Lepus timidus — Common Hare

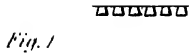
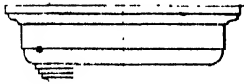


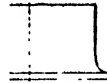
Fig. 1



From the Theatre of Marcellus



Fig. 2



Tuscan Column according to Vitruvius

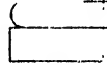


Fig. 3



From the Colosseum

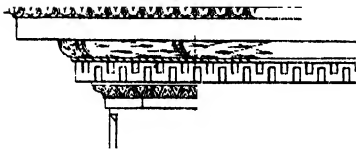


Fig. 3

Fig. 4

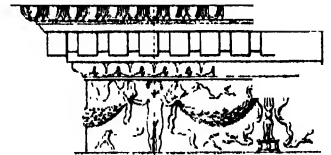
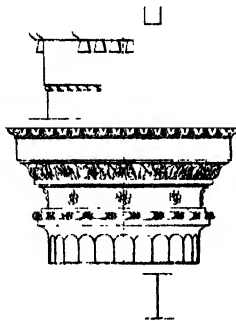


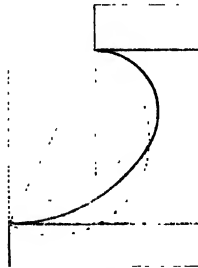
Fig. 5



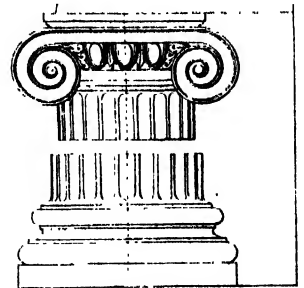
From the Baths of Diocletian

Ionic Volute plan

Fig. 9.



Roman mode of forming a Scotia moulding
(A B is at 60°)



From the Temple of Fortuna Virilis

Fig. 6.

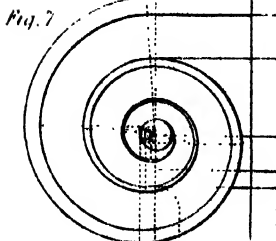
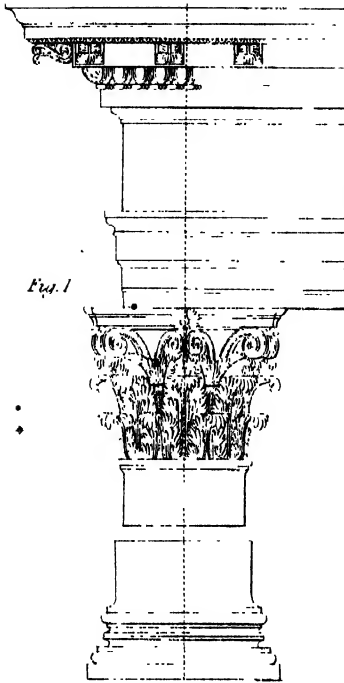


Fig. 7

Ionic Volute according to Goldmann.



Plan or half an Ionic Capital from the Temple of Fortuna Virilis.



Corinthian Column from the Portico of the Pantheon

*Soffit of the
Corona.
Temple of
Jup. Stator*

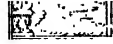


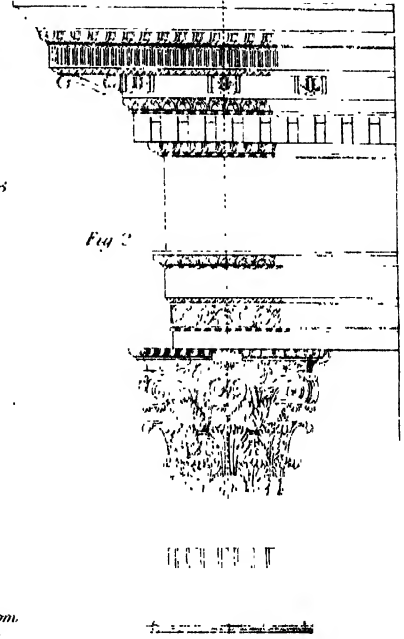
Fig. 3



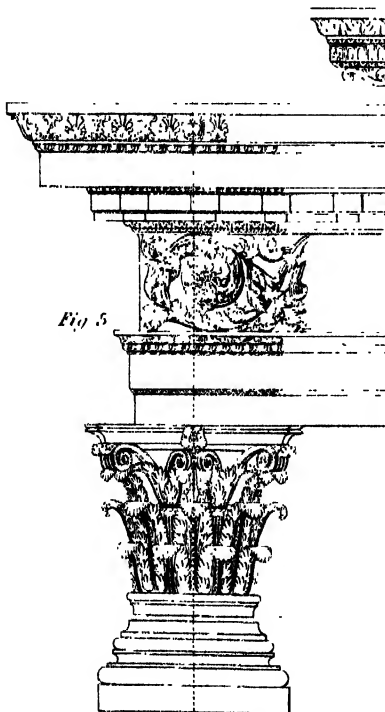
Fig. 4



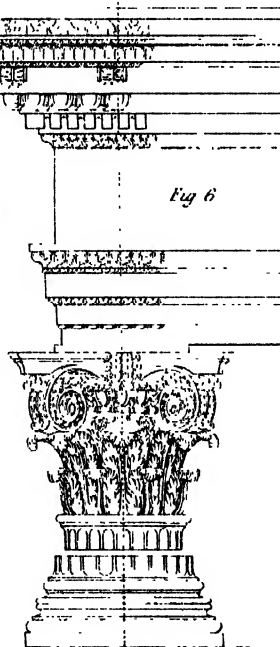
*Plan of a quarter Capital from
the Temple of Jupiter Stator*



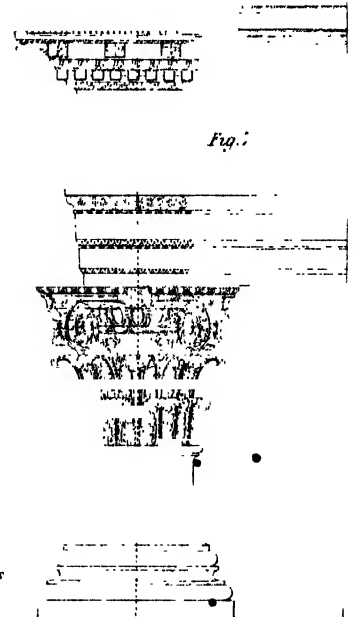
*Corinthian Column from the Temple of
Jupiter Stator*



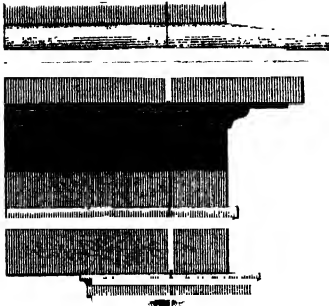
Corinthian Column from the Facade of Nero



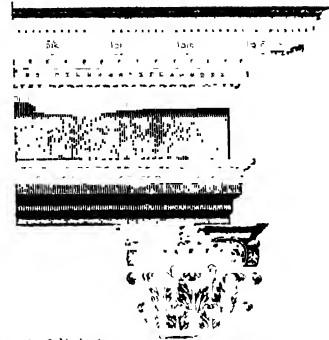
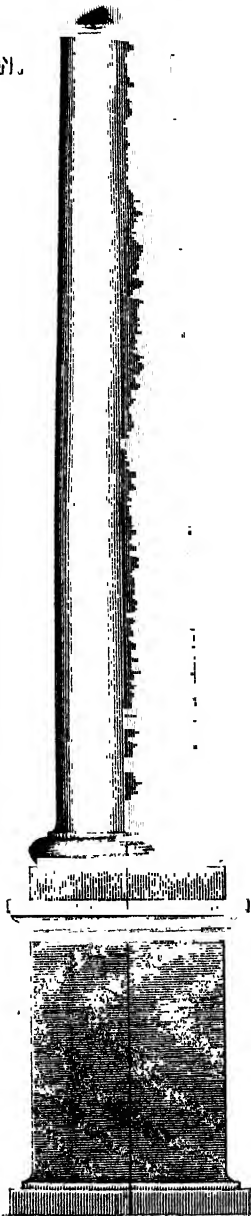
Composite Column from the Arch of Titus



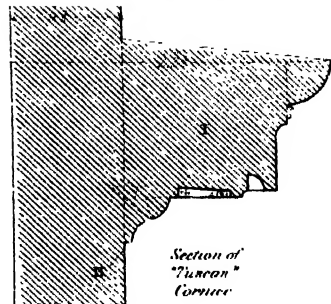
Composite Column from the Baths of Diocletian



TUSCAN.



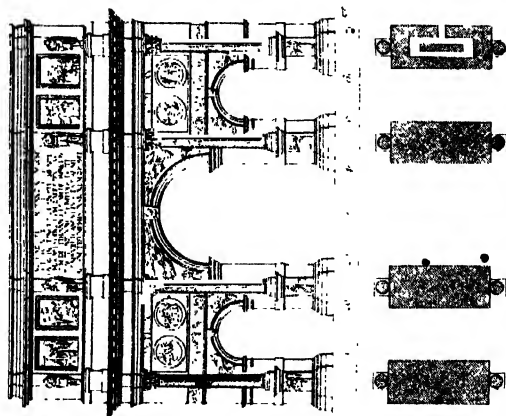
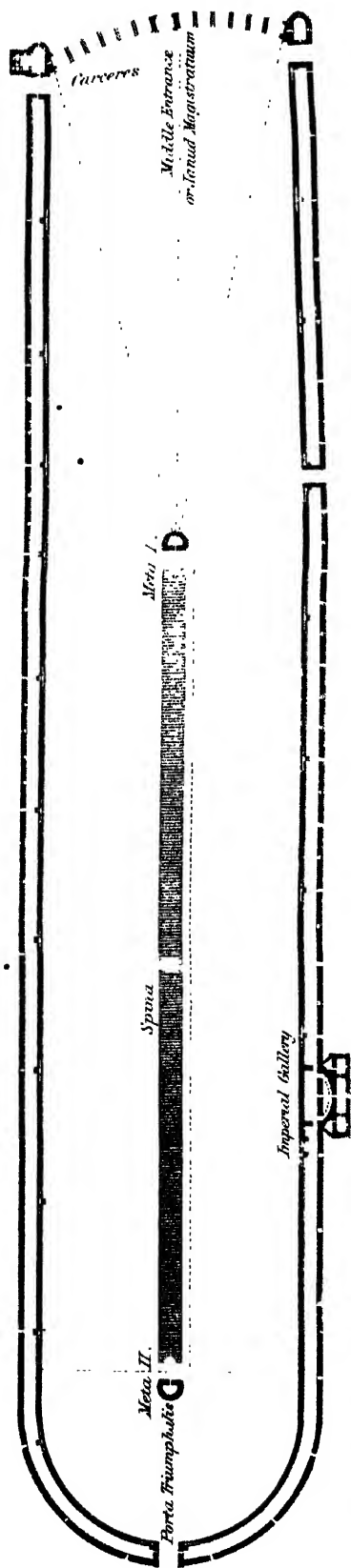
COMPOSITE



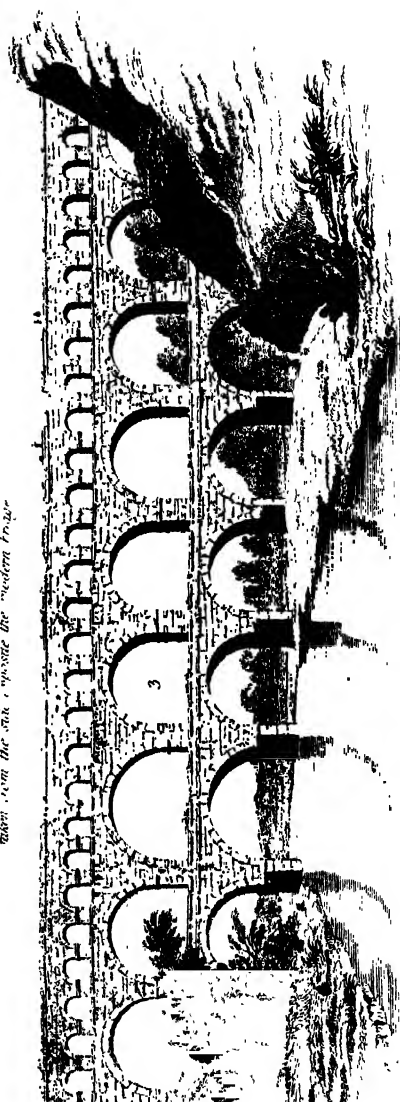
Section of
"Tuscan"
Cornice

ROMAN ARCHITECTURE. PLAN OF A CIRCUS

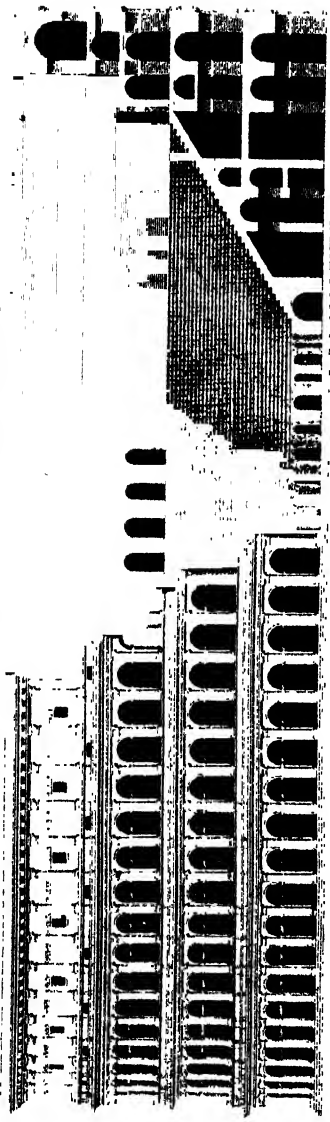
PLATE 4



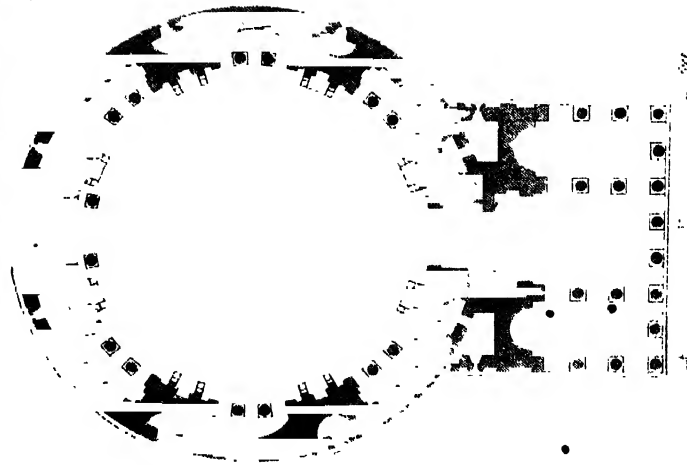
PONT DU GARD NEAR NÎMES
taken from the south, opposite the modern bridge



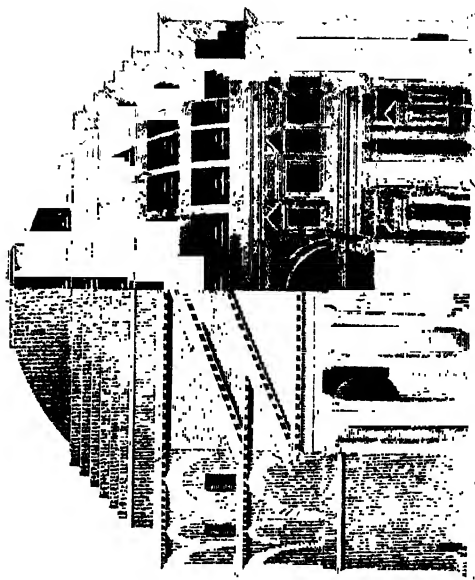
Elevation and Plan of the triumphal Arch at Constantinum



ELEVATION OF THE COLOSSEUM.



PLAN & ELEVATION OF THE PANTHEON.

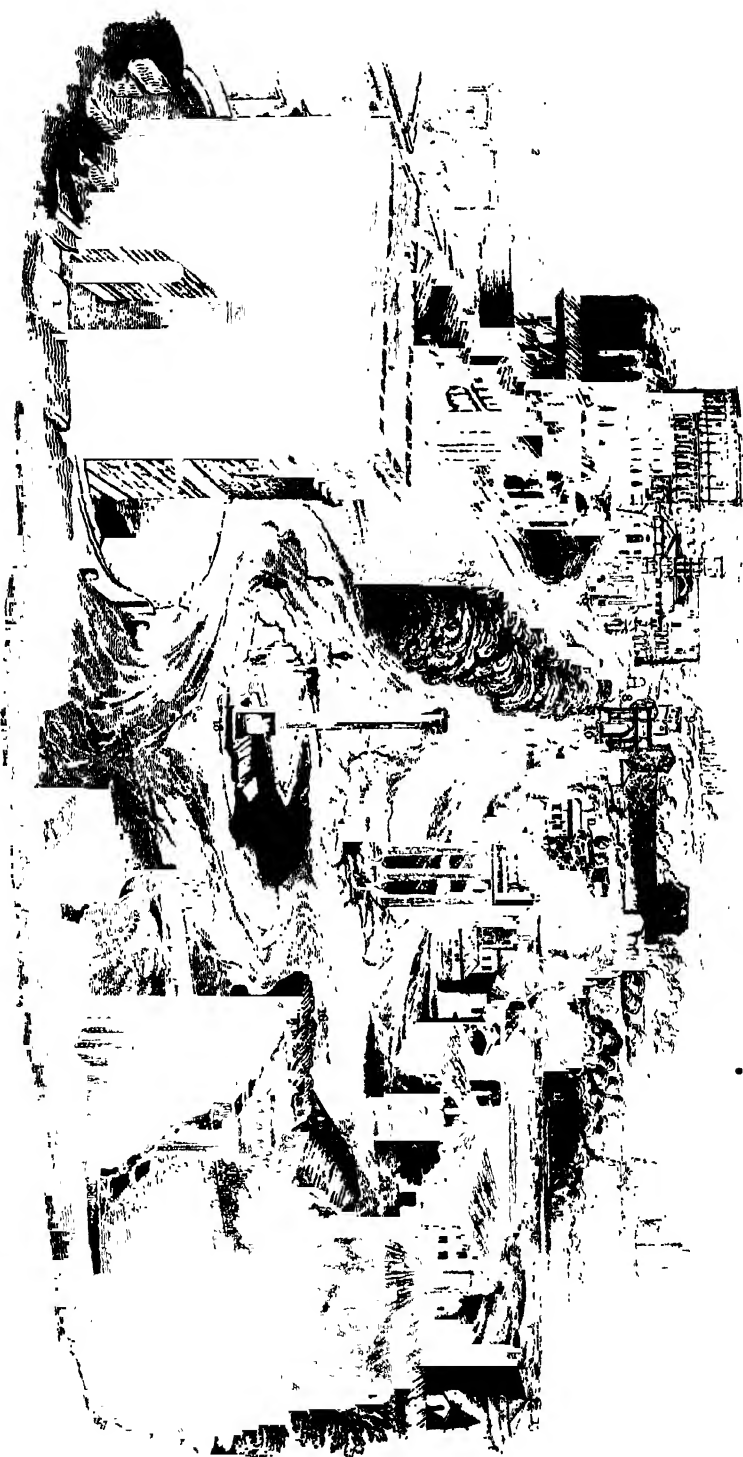


ANOTHER WORLD



P O M E
THE FORUM (CAMPO VACCINO) IN 1830.

PLATE 2.



- 1 Arch of Septimius Severus
- 2 Church of S. Andrea (the ancient Ara)
- 3 Temple of Antoninus & Faustina
- 4 Temple of Romulus behind the Temple of Vesta
- 5 Basilica of Constantine

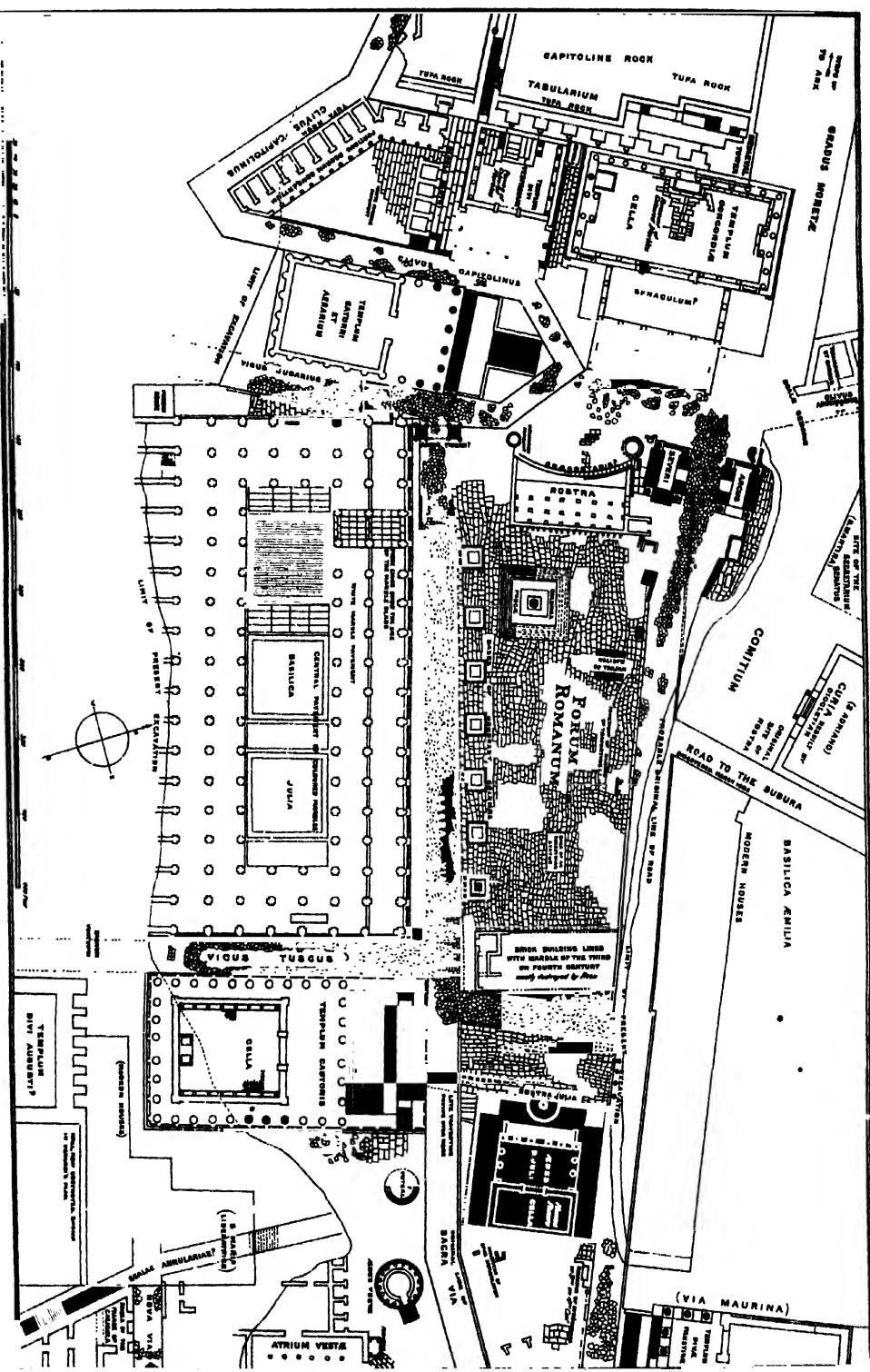
- 6 Church of S. Francesco
- 7 Temple of Vesta & Roma
- 8 Via Sacra
- 9 Arch of Constantine
- 10 Arch of Titus

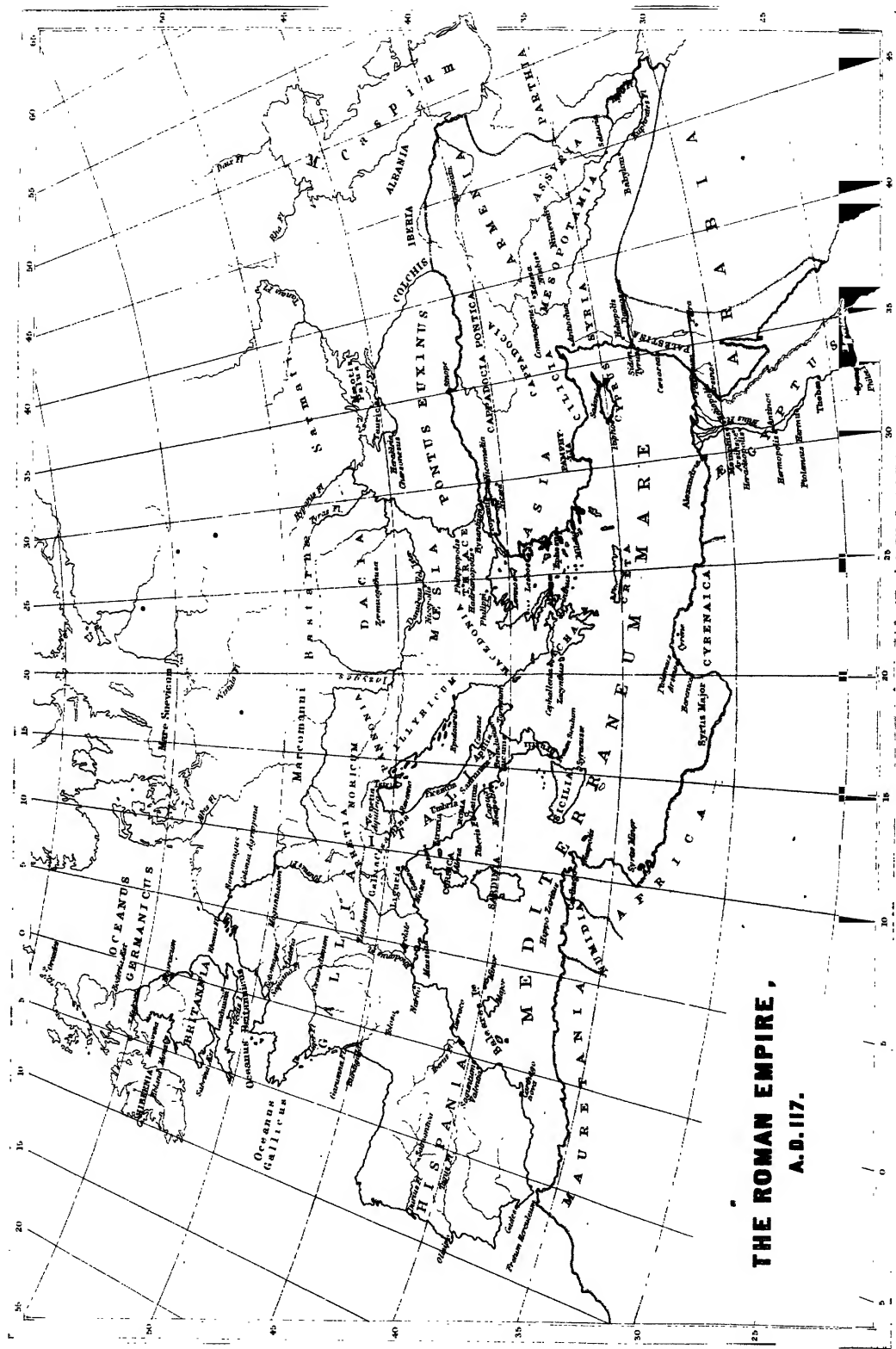
- 11 Opp. Palatine (Palatine Hill)
- 12 Church of S. Maria Liberatrice
- 13 Temple of Castor & Pollux
- 14 Foundation of Trajan's bridge
- 15 Church of S. Andrea

- 16 Temple of Saturn
- 17 Temple of Jupiter
- 18 Temple of Mars
- 19 Church of the Cross (Capitoline)

- 20 Site of Forum of Augustus
- 21 " " " "
- 22 " " " "
- 23 Via de S. Andrea the ancient Via Nova

PLAN OF THE FORUM





THE ROMAN EMPIRE, A.D. 117.

WILLIAM MACNIZEL, LONDON, EDINBURGH & GLASGOW.

LIST OF PLATES.

VOL. XI.

To be Bound at Commencement of Volume in Following Order.

POPPY,	<i>To face Title, Vol. XI.</i>
PICI,	PLATE I.
PINE-APPLE,	„ I.
PISTOLS,	„ I.
PLECTOGNATHI,	„ I.
PLUMBAGO,	„ I.
POLAR REGIONS,	COLOURED MAP.
POLAR STAR,	PLATE I.
POMEGRANATE,	„ I.
POMPEII,	„ I.-II.
PRIMATES,	„ I.-II.
PRINTING,	„ I.-VIII.
PROBOSCIDEA,	„ I.
PROJECTILE,	„ I.-II.
PULLEY,	„ I.
PUMP,	„ I.
REFLECTION AND REFRACTION,	„ I.
REFRIGERATING MACHINERY,	„ I.
REPTILE,	„ I.
RHINOCEROS,	„ I.
RICINUS COMMUNIS,	„ I.
RODENTIA,	„ I.-III.
ROMAN ARCHITECTURE,	„ I.-V.
ROME,	PLATE I.-III.
ROMAN EMPIRE,	COLOURED MAP.

NATIONAL ENCYCLOPÆDIA:

A DICTIONARY OF

. UNIVERSAL KNOWLEDGE.

PIA MATER.

PIA MA'TER, the integument of the brain lying beneath the *dura mater*, and carrying the bloodvessels which supply the brain, and which ramify from it into the brain tissue. See BRAIN.

PIACEN'ZA (*Placentia*), a fortified city of Northern Italy, capital of the former duchy of Parma, and now the principal city of the province of Piacenza, is situated about half a mile from the southern bank of the Po, and 2 miles east of the confluence of the Trebbia with that river, in a fine plain bounded on the south by well-cultivated hills. The town is surrounded by walls and ditches, and has a citadel and five gates. The principal square, in front of the ducal palace, is adorned with two equestrian bronze statues of dukes Raimondo and Alessandro Farnese. Piacenza abounds in fine buildings, the principal of which are—the ducal palace, commenced after the design of Vignola, but not finished; the Podesteria, or town-house, a Gothic building of the thirteenth century; San Sisto, a handsome church, richly adorned; the fine church of San Agostino; and Santa Maria di Campagna, which has some fine paintings.

Piacenza contains 35,000 inhabitants, who carry on a considerable trade in the agricultural products of the country, and in manufactures of woollen stuffs and serges, fustians, stockings, and hats. The establishments for public instruction consist of a lyceum or college, an episcopal seminary, public library, school of the fine arts, &c. There are numerous charitable institutions. The city is 86 miles W.N.W. of Parma by railway. Pope Gregory X., Cardinal Alberoni, Pallavicini, and Laurentius Valla, were born at Piacenza.

Placentia was a Roman colony in 224 B.C. It was taken and destroyed by the Gauls, but was afterwards restored by the Romans. In modern history Piacenza is mentioned as one of the independent Lombard cities. It afterwards had its lords of the families of Pallavicini, Scotti, and Landi. It next fell under the dominion of the Visconti, dukes of Milan. After the death of Filippo Maria Visconti, in 1447, and the establishment of an ephemeral republic at Milan, the citizens of Piacenza revolted against the Milanese, and placed themselves under the protection of Venice. But Francesco Sforza, being appointed commander of the Milanese, retook Piacenza in December, 1447, when the town was given up to pillage. From that time Piacenza remained subject to the Sforza, dukes of Milan; it was taken by the French under Louis XII., and retaken by Pope Julius II., after which it remained subject to the popes, together with Parma, until 1545, when Pope Paul III. gave it to his son, Pier Luigi Farnese. From that time until 1860 it formed part of the duchy of Parma. The fortifications have been considerably strengthened since it came into the possession of the Italian government.

PIANOFORTE.

PIANOFOR'TE. The greatest benefactor to the cause of music among all the musical instruments has been the pianoforte. Its facility of execution, its power and expressiveness as a solo instrument, and its excellence as an accompaniment to the voice or to other instruments, its completeness in itself, and its capacity of perfectly blending with every other quality of tone, quite justify its familiar and friendly title of the "family orchestra." The present wide love of music, and considerable knowledge of it among great masses of the people, are largely due to the pianoforte.

The pianoforte derives its origin from the dulcimer on the one hand, and the harpsichord on the other. The dulcimer, which the pianoforte closely follows in the arrangement of strings, bridge, and sound-board, is a small horizontal instrument struck by small leather-covered hammers with long shanks held in the hand in a manner distantly resembling the way in which a drummer holds his drumsticks. The tone of the dulcimer is agreeable and full, and although all attempts to trace any efforts at using mechanical means to work the "drumsticks" by means of a keyboard have as yet failed, no reasonable person can doubt that so manifestly desirable an end must have exercised the ingenuity of inventors in the middle ages. It is only quite recently that the true inventor of the pianoforte has been known for certain, and it would be rash to assert that we are yet in possession of all the information mediæval records have to furnish on this interesting topic. As will presently be clear, the pianoforte, so far as the evidence now goes, sprang into being practically perfect—a statement which has only to be made to be recognized as absurd. It remains for antiquaries to search out the long years of trial leading up to the grand achievement of Cristofori, of which we know the last step.

Meanwhile a concurrent development had proceeded along two lines, the clavichord and the clavicembalum, the first an instrument of percussion, the second an attempt at a mechanical representation of the harp. Tracing first the clavichord we may consider it as most probably arising about the year 1400 or a little before; for it is definitely mentioned in a MS. of 1404 still existent at Vienna, giving the rules of a company of Minnesänger. The clavichord no doubt arose from the use of the monochord, a stretched metal string used to teach music with. Various notes were producible from the monochord by means of a movable bridge which cut off now one and now another portion of the string, exactly as the violinist stops the string of his violin. We know further that the monochord eventually came to have several strings, so that chords could be shown, &c. Now if instead of moving one bridge to and fro according to the measured distances, we have several sunken bridges, one at each of the several places required (i.e. at the half of the string, at the third, the fourth, the fifth,

and so on), and if these bridges are arranged to be moved up to their places by levers as they are required, we have the germ of the clavicord. Such a keyed monochord almost immediately would yield this further discovery, that when a bridge, or as it was now called a *tangent*, was smartly moved up to its place on the string, it not only cut off the division required to give its characteristic note, but absolutely sounded the note; it struck the string and set it in vibration, and at the same time controlled that vibration by forming a node at the requisite point. A simple application of the organ key-board, and a use of two, afterwards of three strings to each note (we know of a trichord clavicord being in existence as early as 1511), were all that was necessary to produce an instrument with many excellences. First, since a string can produce any number of notes desired, from the prime tone upwards, so that violinists can play elaborate pieces upon one string, so in the clavicord one string (i.e. a group of strings in unison, two or three as the case was) could be made to yield three or four notes to three or four keys, whose tangents struck it at different places. The keys were bent and twisted about curiously to arrange this matter, but it was worth the doing because of the saving of space. Next, there being several strings to a note, the tone was full. Further, it was extremely sensitive, for it is evident that a good player could strike the string with many differences of force, producing shades of difference not only of quality, but of pitch. If the clavicord were played heavily it went sharp, for the strings were pushed up higher than usual, and the tension was increased thereby; consequently it was the easiest thing in the world to make a note tell out, just as when a solo violinist tunes a shade sharp to the orchestra, and is through that simple trick heard distinctly against the whole band. And as the tangent was at once bridge and hammer, a very beautiful effect was obtainable by rapidly increasing and diminishing the pressure of the finger in alternative movement, while yet the key was held down, thereby sharpening and flattening the tone in rapid variation; an effect both in result and in method exactly comparable to the "close shake," which is one of the most subtle means of expression possessed by the violin. It is therefore no wonder that the great Bach and his son, and even Mozart, preferred the clavicord for their own pleasure to all other instruments; for its tone, while very tender, was full of expression, and was more distinctively individual to the performer than that of any other keyed instrument. The damping, that is, the means for causing the vibration of the strings to cease after the note was done with, was effected by strips of list woven through all the strings of the instrument, which perpetually tended to check the vibration of the strings; directly therefore the tangent fell from the string the vibration ceased.

Here we have the percussive element of the pianoforte foreshadowed. The other element, that of general form and construction, was foreshadowed by the instruments of the second or harp-like line of progress. Here one string was used to each note, and was bridged in two places by fixed bridges, so that it gave forth a definite sound, just as the modern pianoforte; but it was plucked or twitched by a plectrum, just as the harp string is plucked by the finger. The plectrum projected from the "jack," and as the jack, attached to the end of the key, rose beside the string, the plectrum twitched it and set it in vibration. In the first instrument of the kind, the clavicitherium, the strings were of gut and the instrument vertical; but in the next, the clavicembalum, which is horizontal, the strings were of metal, usually brass. What the plectra were made of at first we do not know, but we hear of quill plectra as a novelty a little before the year 1500. The quill plectrum once introduced had an undivided reign of three centuries, for the last English plectral instrument was a harpsichord made by Kirkman as late as 1798. About

the year 1500 the spinet took the place of the clavicembalum; this was a small portable instrument, usually standing on a frame, roughly triangular in shape, following in fact the design of the harp. The spinet was sometimes squeezed into a square form and only the upper part of the compass used; this type was a great favourite in England in the time of the "Maiden Queen," from whom it received the name of "Virginals." It was then the custom to speak of everything with ordered degrees as a "pair;" we now only use the term in a "pair of stairs," but formerly a "pair of organs" and a "pair of virginals," were spoken of; "a virginal" or "an organ" would have been scarcely intelligible. The compass of the virginals was usually twenty-nine keys, the spinet had more. Finally, an enlarged form—the harpsichord—still a plectral instrument, came into being; and this in all essentials of the form of the instrument, the arrangement of the bridges, the turning apparatus, the method of damping, &c., was the ancestor of the grand pianoforte, the first pianoforte to be invented. A harpsichord as old as 1521, by Geronimo of Bologna, is to be found to-day in the South Kensington Museum. The compass started at three octaves, but gradually increased to five; and the strings, at first one to a note, increased to two (the jack rising between them, armed with a double quill), and afterwards to three, the third being an octave string, plucked by another jack, operated by the same key. The spinet and harpsichord soon eclipsed the feeble clavicord for the public in general, and from 1600 till 1790, or beyond, had the field of music practically to themselves. (In 1795 the pianoforte replaced the harpsichord in the king's band at Windsor, which may perhaps serve to date the victory of the pianoforte.) Nevertheless great artists found in the clavicord that means of expression which the harpsichord denied them, and everyone sought to obtain the desired piano and forte from the more brilliant instrument. Countless "stops" worked by the feet, or by draw stops, such as those of the organ, were invented; devices for multiplying the strings by using two rows of keys, now worked together with a "coupler," now singly; or for altering the power and quality of the tone by a separate row of jacks, which, when brought into use by the stop plucked the string close against the tuning pin, instead of in the usual place (*lute stop*), or by a contrivance for partly damping the string as it was struck (*harp stop*), and so forth. Among the most ingenious was a patented invention of Schudi's (1769) for a series of hinged shutters in a frame above the sounding board, closing or opening by a pedal, and checking the tone or allowing it to pass freely, an idea greedily seized upon by organ builders, and turned to effect at once as the well-known "Venetian swell," long a peculiarity of English organs. Some attempts were more successful than others, but none were very effective, and the instrument remained inexpressive. There is now no doubt but that the *pian-e-forte* spoken of in letters of a harpsichord maker called Pogliarino to the Duke of Modena (1598), the discovery of which letters caused much stir in 1879, was some harpsichord contrivance of this kind. Further, the harpsichord was a costly possession, for rapid playing soon caused "requilling" to be needed, and requilling was an expensive and time-taking operation.

Under these circumstances a harpsichord-maker named Bartolomeo Cristofori of Padua, who was in the service of Prince Ferdinando de' Medici at Florence, hit upon a plan of an "escapement," that is, a means of allowing the hammer to fall away from the string after having struck it, which at once permitted him to utilize the dulcimer instead of the clavicord principle, and apply the new idea to the harpsichord. This discovery of Cristofori's was shown in 1709 to a friend of the prince his master, who wrote an account of it in a journal under the patronage of Prince Ferdinand himself, and called the *Giornale dei letterati d'Italia* (1711), the instrument being called a *gravicem-*

balo col piano e forte, and a sketch of the action being given. The article was republished in 1719 by the Count Scipione Maffei, its author, in his collected works; but the true date of its first appearance is 1711; he also gives the inventor's name as Cristofali, and both these things have led to much confusion. No action of Cristofori's exactly like the count's diagram has as yet been discovered, but there are now extant two of his pianofortes, respectively dated 1720 and 1726, both being in Florence and in excellent order. The instrument of 1720 (belonging to the Martelli family) is of four and a half octaves, and has been repaired, so that the original form of the hammer is altered; that of 1726 (belonging to the Kraus family) has only four octaves, then the usual compass, and is intact. The action may be represented diagrammatically as below, the illustration showing the principle only, and avoiding the confusion of an accurate drawing.

The hammer, *a*, is seen to be centred to the right hand, its head (square), clothed on the upper surface, being driven up to the string, *s*, by the under-hammer, *b*, which

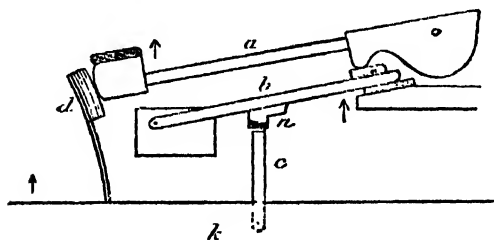


Diagram of Cristofori's action in 1720 (and probably before).

latter is centred to the left. The under-hammer is raised by the hopper, *c*, centred in the key, *k*, and controlled by springs not shown in the diagram. As the hammer returns from hitting the string it falls into the check, *d*. The key is of course centred, so that as the finger depresses the front of it, the back, which alone is here shown, rises. The damper, which would appear, if shown, further to the left than the check, is carried up above the string by the rise of the back of the key; when the back of the key falls again, the damper, no longer supported, falls on to the string from above, thus at once stopping the tone. (It has not been thought necessary to show this simple action.) The smallness of the hammer-head is very remarkable. Except that the hammer-head is made large and oval, and that the hopper now directly attacks the butt of the hammer, the plain grand action of to-day is very similar to the above. It is to be observed that, by the circling of the key, the hopper, *c*, travels to the right as it rises, while the under-hammer, *b*, travels towards the left; consequently the hopper eventually slips into the notch, *n*, this being arranged to take place just as the hammer reaches the string. The hammer is therefore allowed to fall away from the string, while yet the key remains raised (at its back), and while, therefore, the damper is held off the string, and the string continues to sound. When the back of the key falls, *c* is returned to its vertical position by a spring, ready to attack the pad under *b* as before. Cristofori found that the thin harpsichord strings would not bear the stroke of his action. He had therefore first to thicken his strings, and then, because this pulled the hitch-pins out of the sound-board (their original position in the harpsichord) he had to surround the instrument with a separate pin-block. Moreover the wrest-pins (tuning pins) had to be driven right through the wrest plank and the strings put on beneath, so as to give room for the action to be taken in and out, a necessity since obviated by bevelling the upper

face of the wrest plank and letting the strings pass down the bevel and then through holes in metal agraffes, so that they take an upward bearing. Cristofori died in 1731. His art was not effectively pursued in Italy; his instruments had been sent to various countries, and it was in Germany that the Italian idea, so fruitful in its consequence, was to be taken up. Burney, the historian of music, played in 1771 upon the famous Cristofori dated 1730, which the notorious termagant Queen of Spain, widow of Philip V., gave to the singer-minister, Mainelli, who esteemed it above all his considerable possessions. Another famous pianoforte played on by Burney (in 1773) was Frederick the Great's Silbermann at Potsdam, the very instrument tried by J. S. Bach in that celebrated visit of his to the king in 1747—"Gentlemen, the great Bach is here"—and still to be seen in good order. It has the Cristofori action. Silbermann has often been named as the inventor of the pianoforte, or at all events as an independent discoverer—a theory at once disposed of by the fact of his copying all Cristofori's distinctive peculiarities, even to his action. Gottfried Silbermann was making pianofortes as early as 1726, but had not attained success then, and indeed gave them up for some years, returning to the harpsichord. It may be here mentioned that, as a second-rate mechanic, Maelzel, has stolen the invention of the METRONOME, so also a second-rate musician, Schroeter, tried hard to steal the invention of the pianoforte. Luckily he tripped on the old "Cristofali, 1719," error of Maffei, and himself assigned his pretensions to the year 1717. Apart from his theories being useless and unpractical, the simple fact of Cristofori having already made four pianofortes in 1709 sets Schroeter's attempt quite aside. The truth has not yet quite reached into every corner, and it is therefore worth while mentioning.

The next development was the *square* pianoforte, where, by adopting in a large measure the clavichord method of running the strings obliquely from side to side instead of perpendicularly away from the performer, the instrument could be compressed into a small compass. The first maker was Friderici, an Italian organ-builder at Gera (about 30 miles south of Leipzig), but no instrument of his is now known. He is spoken of as having first made a square pianoforte about 1760. A year or two later we have Zumppe, a German harpsichord maker in England, turning out the first instruments of the kind of which we know all the details. There was an immense demand for these handy little pianofortes. Sir George Smart's Zumppe square, dated 1766, is now in the possession of Messrs. Broadwood.

The next dates of importance in the history of the pianoforte are 1773, when Clementi wrote his first sonatas for the instrument (which hitherto had had to depend upon harpsichord music), and 1776, when the first of the Broadwoods assisted Backers in perfecting the plain grand action of the present day, which is, as before stated, a direct descendant of the original Cristofori action. In 1780 Broadwood brought the square almost to its present form, transferring the tuning pins to the back of the instrument; and in 1788, with the help of some scientific men, he made the immense discovery of the necessity of dividing the "long bridge," which in harpsichords is all in one piece. Henceforward the bass strings had a separate short bridge from the treble, and the scale approached more nearly to a scientific exactness. This brought the grand pianoforte to perfection, and in a very few years grand and square together had altogether driven harpsichords before them. Yet Mozart, who died in 1791, never thoroughly liked the pianoforte. His concert instrument (by Walter, five octaves, black naturals and white sharps) is preserved in the Mozarteum at Salzburg.

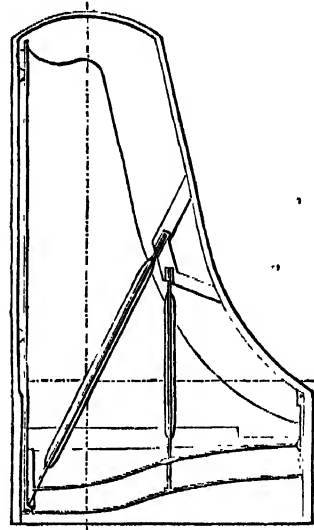
The light Vienna action, which shares the supremacy with the English action for grand pianofortes (each with many modifications), was the invention of Streicher of

Vienna in 1794, its main peculiarities being that the centre on which the hammer turns is supported from the key and rises with the back of the key, the escapement being against a fixed hopper behind, the hammer-head being nearer to the performer than its centre, exactly the reverse of the conditions of the English action. At this time the compass was five and a half octaves (F to C). In 1796 the first six-octave pianoforte (C to C) was made, which is Beethoven's compass; by 1811 this had given way to six and a half octaves (C to F). To finish this branch of the subject it may be added that it took over thirty years to gain another note in the treble, and that still another was reached by 1850, being the familiar six and seven-eighths octaves (C to A). The bass had meanwhile extended occasionally to A, and in one or two cases to G. Shortly after 1850 the bass A became very usual, and by 1855 the seven octaves, still the usual compass (A to A), became general for all but cheap instruments. A few instruments are now made of seven and a quarter octaves (A to C), but this scale has not shown any tendency to become general.

In 1800 Isaac Hawkins invented and patented the *upright* pianoforte, a small successor of the enormous upright grands (1787 and *seq.*), which were grand pianofortes standing vertically, supported on a frame, with their keys bent at right angles to the instrument in a clumsy fashion. Hawkins' instrument (shown at the International Exhibition, 1885) was not generally adopted; and the next advance was the cabinet, made by reversing the upright grand, bringing the tuning pins to the top, allowing the strings to go down to the floor, and thus reducing the instrument to about 7 feet in height. A very tall action was used, on a plan invented by Southwell (1807), which was the ancestor in all essentials of the plain cottage action, now fast disappearing. In 1811 Wornum further reduced the height of the cabinet by slanting the strings, and in the same year the more correct form of the *oblique* upright was discovered by Collard, who obtained it by setting the square pianoforte on its side. Wornum finally obtained the cottage pianoforte of the present height in 1813, and the check action for upright instruments, which still remains the best, is due to him also (1828), though from its almost invariable employment in France it has come to be known in the trade as the "French action."

The weakness of the grand pianoforte, where the hammers strike through a large gap in the centre of the instrument, had early made itself felt, and was provided for by arches of steel connecting the two parts, invented by Stodart about 1785. The constantly increasing strength of wire used caused a corresponding increase of power in the framing to become necessary; and this was first met by Stodart's tubular metal frame extending above the strings (Allen's patent, 1820), passing eleven years later into a plan for casting the string plate, tension bars, and wrest-plank plate all in one (1831). Meanwhile a similar plan of a single casting was elaborated by Babcock in America (1825) for a square pianoforte, which was developed to a most successful issue by Chickering in 1837. Later on Chickering devised a single casting of his own design for grand pianofortes. In 1835 Boehm, the great improver of the orchestral flute, hit upon the plan of "over-stringing," that is, crossing the strings so as to get two systems of oblique stringing in one instrument, and thereby to obtain long strings in a small case. This idea was combined with his iron plate by Chickering, and the first iron overstrung square was produced by him in 1853, a system further developed for upright instruments by the American house of Steinway. The iron frame, in one casting, supported by a wooden frame, is now the usual construction of pianoforte, whether horizontal or vertical; but many makers prefer direct stringing to over-stringing, as giving a purer and more even scale, which is a quality so valuable as to outweigh the advantages of long strings gained by the

other method. Some makers still prefer a frame not all in one piece, and the annexed illustration shows an excellent specimen of the class, the well-known frame of Broadwood, introduced in 1847, and still retained.



Broadwood's Iron Frame.

It only remains to say a word about the pedals of the pianoforte. The one pedal of the earliest instruments came to them from the harpsichord; it raised all the dampers at once (*forte* pedal, "loud pedal" or "damper pedal"). Its use as a *forte* pedal, simply to increase the sound, was so evident that in the earliest squares of Zumpo and onwards down to 1830, we find the pedal-foot cut in two longitudinally, giving the performer the option of raising the bass dampers with the one half, the treble with the other, or by pressing down both halves of the pedal at once of raising the whole of the dampers at once. This device died out, or nearly so, in 1830; but quite recently it has been revived and extended by Zachariä of Stuttgart, who uses four such divided pedal feet, and thus obtains as many as eight sections of dampers. Zachariä's arrangement (the *Kunst pedal* or "artistic pedal") is the *ne plus ultra* of fastidiousness, but it would be wrong to say it is not without effect. Simply, the effect is not worth the trouble taken to obtain it. What weighs upon the mind of such critics of the pianoforte is the fact that the usual *forte* pedal, by raising all the dampers at once, does a great deal more than set free the whole of the strings just struck. For the entire compass of the instrument being free to sound avails itself of its freedom, and therefore by the laws of sympathetic resonance, one chord struck with the *forte* pedal down will set the whole instrument more or less in vibration. There will be few strings which will not vibrate, either wholly or in sections, because of that chord. All partial tones that relate to its notes, or to their partial tones, or to their combinational tones will be excited. The lower the notes of the chord struck the greater its power of multiplication of sound. The well-known effect of a full chord with the *forte* pedal down is comparable to that of a rich-toned organ with a large number of soft stops sounding at once. The use of this pedal easily degenerates into coarseness. The same cause that made our ancestors love the drone of the bagpipe or the hurdy-gurdy makes the common pianoforte player take delight in the continued hum of the *forte* pedal, which is kept down during the whole performance. But the mixture and confusion of harmonies thus given is

insupportable to a refined ear, and it is imperatively necessary to pure musical effect to "change the pedal" (i. e. to allow it to rise and instantly to depress it again) at each change of harmony. Those who watch a performer of the first rank will see his right foot in a constant unconscious tremor when the *forte* pedal is being used; in the rapid course of the harmony it can scarcely remain still an instant.

There are in all modern pianofortes at least two pedals. The second pedal is the *piano* pedal or "soft pedal," and its use is out of all comparison infrequent to that of the *forte* pedal. Few players of the highest rank use it at all, save for exceptional passages, preferring to graduate the tone by the different power of the touch, because the usual *piano* pedal alters the quality of the tone at the same time that it reduces its power. There are several varieties, and sometimes two of them will be found in the same instrument (giving three pedals in all). The first *piano* pedal was Broadwood's (1783), a very soft buffer of cloth pressed down upon the strings and acting as a mute, in fact an application of the "harp-pedal" of the harpsichord: this is not now used. (1) The *shifting* pedal, carrying the action sideways so that the hammers strike one string out of two, or two strings out of three, was invented by Stein in an instrument called the *Saiten harmonica* in 1789. It has two varieties, the older (still used by Broadwood), which shifts the entire action, the newer which moves much more easily, shifting only the hammer rail and leaving the keys and the lower part of the action stationary. The danger of this pedal is the change of tone, which at once becomes thin when it is used; but the sympathetic resonance of the muted strings when the *forte* pedal is pressed down at the same time with the shifting of the *piano* pedal gives a strangely beautiful and ethereal effect in the hands of an accomplished performer. Beethoven has many "una corda" passages, and Chopin in actual performance relied much upon this effect, though he has very rarely marked it in the score. (2) The *céleste* pedal boldly changes the tone altogether, and has of late years become a much more popular *piano* pedal than the shifting action. It acts by inserting a long strip of fine felt between the hammers and the strings, so that its operation is that of thickening and softening the covering of the hammer. In carefully made instruments it is divided by vertical cuts, lest when one note is struck the undivided *céleste* felt should, by rubbing against the neighbouring notes, set them also into gentle vibration. The invention was an early one, due to Sebastian Erard as long ago as 1805, the name *céleste* being given to it by the composer Adam; in Germany it is called the "flute" pedal, and both names endeavour to express its delicious sweetness and veiled effect. It is most useful in detached echo-like passages, but is quite useless for crescendos and diminuendos, as the complete alteration of tone prevents an ordinary performer from "going into it and out of it;" it must be taken and left by a sudden plunge. (3) A third variety is now much used in Germany and in America, and will not improbably in time become the most favourite pedal of the three. This pedal acts by raising all the hammers half way to the strings, and therefore largely weakening the force of the action. It has the great merit of not altering the quality of the tone in the slightest, but the disadvantage of destroying the pleasantness of the touch. It is not much more effective for a good player than playing softly without any pedal at all, but for indifferent performers (since for them this last is not accomplishable) the new pedal is a great boon.

A third variety of pedal is the "sostenente" or "tone-sustaining" pedal, which acts partially upon the dampers. When a chord is struck and this pedal instantly pressed down it catches the dampers of that chord, raised by the act of striking, and prevents them returning to damp the string; so that a player may set a chord resounding, keep it so by the *sostenente* pedal, and then leave those keys for

any flourishes or lacer-work passages with which he may wish to embroider the harmony which continues to be heard. The notes of a melody or of a "pedal-bass" may be kept sounding in this way while both hands are free to provide the accompaniment. The pedal is, however, not nearly so useful in actual use as its description indicates; and, moreover, the construction of such passages usually renders the ordinary *forte* pedal sufficiently effective, while it is much easier to work with.

It is of course impossible to cast the future of the pianoforte. The attempts of the PIANO-QUATUOR and PIANO-HARMONIUM to obtain a continuance of sound are indications of what is still felt to be lacking in the "family orchestra." From time to time a "Melo-piano" or an "Organo-piano" is put forward by one or another manufactory, the fundamental principle of which consists in striking the strings with immense rapidity of repetition, producing a continued rattle. After all, this is only an effect of a rather more refined kind to that which is familiar to every one in the mechanical pianoforte of the street, and "that way madness lies," the tremulous effect being as intolerable to a sensitive ear as a flickering light to a sensitive eye. Attempts have also been made to control a string by means of fastening it to a vibrating reed or spring, and in this direction discoveries may certainly be looked for, though it is probable that the quality of tone now so delightful in the pianoforte will be changed.

PIANO-HARMONIUM (or *Orgue-piano*), a combination of pianoforte and harmonium, both instruments being played by one set of keys, the wind of the harmonium being supplied by feeders in the place usually occupied by the pianoforte pedals, and the latter being worked by levers for the knees. Sometimes an American-organ (suction) is substituted for a harmonium (pressure). It is always so arranged that by stops either the treble or the bass of the pianoforte, or the treble or bass of each row of vibrators of the harmonium, can be thrown out of gear; while if all the stops are drawn, all parts of the instrument are brought into simultaneous action by the one set of keys. The result is that at the will of the performer the ordinary staccato tones of the pianoforte can be prolonged. The instrument is capable of many varieties of tone by means of skilful adjustment of its stops. It needs careful manufacture, or the pianoforte part will quickly get out of tune with the more stable harmonium part, and the two parts will become very discordant with each other. When well made, however, it is remarkably effective. Other names for the instrument are "Combination Pianoforte" and "Orchestral Pianoforte."

PIANO-MECANIQUE (Mechanical Pianoforte), a clever invention of Debain, dating from about 1850; and consisting of an additional apparatus worked mechanically, fixed to an ordinary upright pianoforte. A powerful lever raises the top of the instrument, and carries with it the mechanical action, when the instrument is desired to be played in the usual manner. If it is desired to play it mechanically, the mechanical action is lowered by the lever, and in the act of descending thrusts the ordinary action out of place, inserting itself wedge-fashion between it and the strings. The ordinary action can now not be used until the top is again raised, since it is necessary from the construction of all pianofortes that the strings should be struck at one particular spot (the striking point), and therefore only one action at a time can be in use. The hammers of the mechanical action hang downwards, and are connected by levers with a row of closely set pins projecting transversely above a metal plate on the (inner) top of the pianoforte. Large flat pieces of wood, studded with pins, and called planchettes, are placed, pins downward, on the metal plate, and are moved along by the operation of turning a handle. The pins in the planchettes press down the pins of the mechanical action, and so cause the hammers

to be driven against the strings; in fact they play upon these pins as the fingers play upon the ordinary keys. The planchettes are made in a convenient size, and many of them are used, in their due numbered order, in the performance of a long piece. An ordinary piece costs £3 or £4 for the planchettes; but once bought, is of course permanently available. Overtures and sonatas cost a great deal more, on account of their greater length. The effect of the mechanical action is very good at a little distance; a small amount of expressive power is possible, but not much. The great defect is the impossibility of a proper use of the damper pedal.

PIANO-QUATUOR or **PIANO VIOLIN**, the invention of a Frenchman named Baudet in 1865, is an attempt to produce the effect of a string-quartet upon a pianoforte, played by keys in the usual manner. Instead therefore of striking the strings with the hammers of the usual action, the strings are each supplied with a stiff projecting piece of catgut; a long rosined barrel, extending from bass to treble all along the instrument, is constantly rotated by a mechanism worked by the feet, and represents the bow of the violinist; when the key is touched by the finger the corresponding catgut is pressed against the barrel, and throws the string into vibration as soon as it touches it, keeping up the tone moreover so long as the feet continue to cause the barrel to turn. The barrel sets the catgut into vibration, and the catgut conveys the vibration to the string; then the vibration (which may originate at any rate per second as it chanches) is at once controlled by the length and tension of the string to the definite vibration-number of that string. The tone of the instrument has much that resembles the violin, but cannot be said at all to replace the charm of the quartet of stringed instruments. The effect of the attack of the bow, and the delicate effects produced by variously dividing passages between the up and down strokes of the bow (technically called "bowings") are of course not attainable; and one misses all harmonic effects, and the variations of a quality due to repeating a passage upon other strings than those upon which it was first played, and many other such delicious nuances of the real violins. Still the power of sustained sound of the piano-quatuor is a valuable quality.

PIASSAVA or **PIACABA** is a vegetable fibre largely imported into England from Brazil, and used for making coarse brushes and brooms.

For the Brazilian navy it is manufactured into cables. It is produced by several varieties of the palm, especially the Piassava Palm (*Attalea funifera*), and consists of the stalks of the large fan-like leaves; the finest fibre is obtained from *Leopoldinia Piassaba*. The piassava fibres are of a brown colour, very hard, and vary in thickness from that of a horse hair to a quill. By its extensive use, it is rapidly superseding the old birch brooms and the whalebone brushes. It is shipped to this country in bundles of about 16 lbs. each. The nuts of the piassava palm, shown in section in the



Piassava Palm.

accompanying cut, are large, with a hard shell, and are used for turnery work.

PIAS'TRE, an ancient name for a coin as much used in the East as "penny" and "pennig" have been in the West, and with as various values; and used moreover in

Spain and in some of the Spanish South American states. The word comes from the Greek *emplastron*, something spread out as an apothecary spreads a plaster, and hence a disc or coin flattened out under the coiner's hammer, so that it may be taken as synonymous with the word money. The piastre is the unit of value in Turkey, Egypt, and Tunis, and is divided into forty paras.

Turkey.—The gold piastre of Turkey is represented by the 100-piastre piece, commonly called the *pound Turkish*, weighing 7.216 grammes, .9166 fine; and the hundredth part of which (i.e. the piastre) is therefore equal to 2.16 pence English. The silver piastre of Turkey is a coin weighing 1.203 grammes, .830 fine; and therefore worth 2.11 pence English.

Egypt.—By the tariff 97½ Egyptian piastres go to the English sovereign, which gives a value of 2.161 pence. As determined by the *pound Egyptian*, a gold piece of 100 piastres in value, weighing 8.544 grammes, .875 fine, the piastre equals 2.4477 pence; or by the silver piastre of 1.25 grammes, .900 fine, it is worth 2.378 pence. Roughly speaking five Egyptian piastres go to a shilling. This sounds simplicity itself, but in practice it is very difficult to settle payments in Egypt. First, the silver piastres, the government money of account, are usually so worn and defaced that they cause endless higgling, and moreover, there is nothing like a sufficiency of them, and the exchange value of other coins of course leads to more trouble. Then the copper piastres issued by the Egyptian government have lately been repudiated by them, and now pass only at one-seventh of their value; yet the small dealers still prefer to reckon prices in copper. Finally, the better class of shopkeepers always reckon in a conventional piastre of their own, worth just half as much as the government silver piastre. Truly the piastre may stand as a type of Egyptian finance, for many generations past a hopeless muddle.

Tunis.—The piastre of Tunis is worth much more than double of the tariff piastre of Egypt. It is represented by a silver piece 3.097 grammes, .900 fine, worth therefore a little over 5½d. The 100-piastre piece weighs 19.5 grammes, and is .900 fine, whence the value of the piastre comes out at a trifle under 5½d.

Arabian piastre or *Mocha dollar*, the unit of value in Arabia, is worth 8s. 5d. within a small fraction.

Spanish Piastre.—This is synonymous with the *dollar* or *duro*, equal to 4s. 1½d. and is gradually disappearing before the 5-peseta piece of the Latin monetary convention, which is now very frequently called by the name of *piastre*, but is only equal to five francs (i.e. 47.578 pence), nearly 2d. less than the older coin. The *piastre* or *peso* of Uruguay is identical with the 5-peseta piece of the Latin convention.

PIAZZA, a term adopted in its original form from the Italian, but with a great change of its meaning; for while in that language it signifies merely an open place, or public square, it is employed by us to denote a covered ambulatory, whether formed by columns or arches, in the lower part of a building; such cloistered walks being very common in the *piazze*, or public squares, of Italian cities, as that of St. Mark's at Venice, &c.

PIBROCH (Gaulic *piobaireachd*, a pipe-tune), in Scottish music, the march or dirge of the Highland clans. It is played on the bagpipe, and has a remarkable effect in rallying troops, or inciting them to attack in battle, or in expressing the grief of the mourners. There are different pibrochs or martial tunes belonging to various clans and districts. Connoisseurs in the music of the bagpipes affect to discover in a well-composed pibroch the imitative sounds of march, conflict, flight, pursuit, and all the events of a fight; but to the uninitiated ear it is difficult to appreciate. The scale of the bagpipe is so very unlike our ordinary scale that the pibroch sounds out of tune, and the very irregular, almost rhymeless style of movement makes it hard

for a stranger to follow. In nearly all cases pibrochs take the form of an air (*wilar*) and variations.

PICA, a printing type of this size [**Pica**], probably named from *litera picata*, a great black letter at the beginning of some new rubric in the liturgy.

PICCINNI, NICOLO, a musical composer, was born in 1728, at Bari in the kingdom of Naples, and died at Paris, 7th May, 1800. His father, also a musician, destined him for the service of the church, but against his father's commands he clandestinely studied the art by which he gained his renown. His untalented proficiency was accidentally discovered, and his father was then convinced of the desirability of allowing him to pursue his own strong inclination. This was in 1742, when Piccinni was accordingly placed in the conservatorio of S. Onofrio at Naples. There he was assigned to the care of one of the primary masters—advanced students of the institution; but the bare formality of explanations he received from this inexperienced teacher was so distasteful to Piccinni, that he neglected his exercises, and wrote an entire mass without aid or direction. This breach of discipline was reported to Leo, then the principal of the conservatorio, who rebuked him for squandering the powers of his mind upon a creation which he knew not how to cast into shape, but received him as his own pupil, and gave him daily lessons. Upon Leo's death, Piccinni passed into the hands of his successor, Durante, under whom he completed his studies. On quitting the conservatorio in 1751, he wrote his first opera, "*Le Donne dispettose*," and his name rose so rapidly that in 1756 he was commissioned to compose a serious opera, "*Zenobia*," for the chief theatre. Gaining mastery by every new production, he at length brought out, "*La Cecchina, ossia la buona Figliuola*," the most popular of all his operas, in 1760. The enormous success of the "*Buona Figliuola*" prompted the managers of all the theatres in Italy to invite Piccinni to write for them, and his prodigious fecundity enabled him to satisfy almost all their demands. As a proof of this may be noted that within seven months, in 1761, he brought out no less than six operas, of which three were serious and three comic, in six different cities.

Piccinni retired to Naples in 1773 after a serious illness brought on by the vexation of a first failure at Rome, and opened a fresh career of success. It was now that the memorable excitement on the subject of dramatic music arose in Paris, and Piccinni was invited thither to represent the merits of the Italian school in opposition to Gluck, whose operas were so admired by one court party there, that the rival faction required also a favourite who might contest the claims of this master. He arrived in Paris in December, 1776. His total ignorance of the French language was a great hindrance to him, but Marmontel, who modernized Quinault's libretto of "*Roland*" for him to set to music, explained to him the sense and the accent of every word as they went on. The opera was not produced until January, 1778, and on its first night, so violent were the cabals against Piccinni that when going to witness the performance, he parted from his family with feelings like those of a malefactor who is led to trial. "*Roland*" was well received, but its success was incommensurate with the expectations of his party, and their virulence, like that of their opponents, was heightened in consequence. The feud between the supporters of the two schools became of almost national importance, absurd as it now seems to compare Piccinni's mere excellence with Gluck's transcendent genius. In all societies of the day the first question was, "*Are you Gluckists or Piccinnists?*" Even the fickle Parisians, however, saw the infinite superiority of Gluck's immortal "*Iphigénie en Tauride*" over Piccinni's opera on the same subject, and indeed the latter was ruined by a wit on its first production, for the prima

donna being evidently not sober the opera was nicknamed "*Iphigénie en Champagne*," a *bon mot* which convulsed the house as it spread from mouth to mouth, and altogether spoiled poor Piccinni's chances. To console Piccinni for the disappointment he endured in Paris, the queen, who was Gluck's chief patron from the first, did him the honour to take singing lessons of him, for which, however, she paid nothing. Gluck had finally left Paris in 1780, but a new rival was raised against Piccinni; this was his own pupil and his friend Sacchini, who for faction's sake was adopted by the Gluckists, when they had no other hero to oppose to his rival. A large pecuniary loss occasioned by the revolutionary disturbances induced Piccinni in July, 1791, to take leave of France. Returning to Naples, he was honourably received by the king, but the marriage of his daughter to a Frenchman caused him to be suspected of republican principles, and in 1793 he was placed under arrest for his political sentiments, and confined to his own house for four years. During this period of retirement he set several pieces of sacred music. On the intercession of the French commissioners he was freed in 1798, revisited Paris, and was liberally welcomed by the First Consul, and was promised a pension, which, however, he received very irregularly. Finally he received the office of inspector of the Conservatoire, but almost immediately afterwards an attack of paralysis brought his life to a close (1800). Fétis gives the names of eighty dramatic works, including oratorios, but the real number is certainly higher. Both a son and a grandson of Piccinni were creditable musicians in their day. Piccinni's chief title to be remembered is his rivalry with Gluck, but it must not be thought from this that he was a contentious man. On the other hand he was of a most kindly and amiable disposition; for instance, when Gluck, died in 1787 it was Piccinni who was foremost in endeavouring to perpetuate his memory by annual prizes and concerts, calling him the "*Cornicelle of opera*," together with other marks of his generous esteem.

PICCO PIPE, a small pipe of the whistle kind, not very often seen, on account of the difficulty of its manipulation, but capable of varied effects in competent hands. It was introduced to this country in 1856 by a blind peasant named Pico, a native of Sardinia; and he could with ease play in a compass of three octaves. It is the simplest instrument we have, simpler than even the penny whistle, for this is over 8 inches long and has six holes, whereas the piccolo pipe has but three holes and measures in all only $3\frac{1}{2}$ inches. It spreads out conically, ending in a small bell, like the oboe, &c. Two holes are bored on the upper side and one on the under side of the pipe, so that they are governable by the thumb and two fingers of one hand; meanwhile the other hand either closes or partly closes the bell with the palm, or with the little finger inserted up the pipe. In this way, aided by the fingers varying the closure of the ventage-holes, a complete scale of semitones can be given; but it requires great skill in manipulation to produce them truly. The tone is shriller than a flageolet, but sweeter than a piccolo; and unlike those instruments it is capable of much expression. It is, of course, evident that its great peculiarity consists in its use now as an open, now as a stopped pipe.

PICCOLO (Ital. *flauto piccolo*, small flute), a flute of small dimensions having the same compass as the ordinary flute, at the octave higher. It is a very effective instrument in an orchestra in lively and passionate music, its range being about two and a half octaves, from *d''* to *a'''*. It is the only instrument in the orchestra (except the violin) which reaches as high as the pianoforte or the smallest stops of the organ, and its tone is very brilliant and piercing. About an octave at the bottom of the register and half an octave at the top are not much used, the first being too dull, the second too shrill for efficiency.

PICE (plural of pie), Hindu copper coinage, 12 pice making an anna, and 192 pice going to the rupee. The pice of Singapore have the same value. If the rupee be taken as worth 22·6 pence the pie is worth ·1177*d.*, a trifle over a ninth of a penny.

PICEA is a genus of plants belonging to the order CONIFERÆ and tribe ABETINÆ. It is by some regarded as a subgenus of Abies. It is chiefly distinguished by the erect cylindrical, thin-scaled cones. The typical species *Picea pectinata* or *Abies Picea* (the silver fir). See ABIES.

PICI is an order of BIRDS containing those commonly known as woodpeckers, which were formerly classed with the Passeres; according to Parker they form a group, Saurornathæ, so called from the simple and reptilian character of the palatal system. In this order the bill is straight, wedge-shaped, and very hard. The tongue is capable of extraordinary extension. The two cornua of the hyoid bone extend round the back of the head, and are attached to the cavity of the right nostril. These bones are accompanied by muscles which, by their contractions, enable the tongue to be shot out and retracted. The sternum or breast-bone has two notches posteriorly, and the posterior extremity of the shoulder-blade is hooked. The feet are short and stout, with the first and fourth toes turned backwards. The tail feathers are stiff, and form a prop against the tree.

Most of the Pici climb on the trunks and branches of trees, nesting in holes in their interior; they feed on insects and worms, or on fruit. This order contains three families, Picidæ (Plate, figs. 1, 2), the Common Woodpeckers, Iyngidæ, containing the WYRNECK (fig. 3), and Picumnidæ.

PICKLES, a term usually applied to those parts of vegetables which have been preserved in vinegar, and are used as a condiment or relish with other food. The articles intended for pickling are first washed in cold water, having been cut into pieces of various sizes, and are afterwards soaked for a few days in water strongly impregnated with salt. They are then taken out and drained, or, if fruits and roots, dried in a cloth; and are next placed in suitable vessels with a few peppercorns and other spices, which are sprinkled in occasionally. As soon as the vessels are filled, boiling vinegar is poured in, and they are then carefully covered over. This is but an outline of the processes adopted, which are modified by different manufacturers according to their special recipes and the species of fruit or vegetable intended for pickling.

The principal pickles used in England are—red cabbage which is largely prepared at home; cauliflowers, of which only the flowering portion of the young branches is used; gherkins, or young cucumbers; French beans; onions (the small, button-like, silver-skin variety); walnuts, which are gathered green; nasturtium, the seeds of the nasturtium or Indian cress (*Tropæolum nasturtium*); and mushrooms. Mixed pickles, consisting of a variety of vegetables; piccalilly, which is rendered thick and yellow by the addition of a considerable quantity of mustard seed and flour of mustard; mangoes, capsicums, olives, and capers, are also favourite pickles at the table of the wealthier classes.

PICO DELLA MIRANDOLA. See MIRANDOLA.

PICOLINE or **O'DORINE**, a soluble alkaloid found in bone oil, in the tar of coal, peat, and shale, and in other products of destructive distillation. It is a colourless liquid of powerful odour and bitter taste. It boils at 185° C. (275° Fahr.) The specific gravity is 0·9613, the formula is C₈H₇N. It combines with acids, forming very soluble crystalline salts.

PICRAMIC or **DINITROPHENAMIC ACID** (C₆H₅N₂O₆) is obtained by the action of reducing agents on picric acid. It crystallizes in beautiful red needles. It is insoluble in water, but soluble in alcohol and ether.

It forms red crystalline salts, having the general formula, C₆H₄MN₂O₆. These, like the picrates, generally detonate when heated. *Phenol-blue* or *azulin* is a blue dye obtained from pæonin by heating it with aniline.

PICRIC or **TRINITROPHENIC ACID**. See PHENOL.

PICROTOXIN, the poisonous principle of the *Cocculus indicus*, *Menispermum cocculus*, natural order, Menispermaceæ. It crystallizes in needles, which are extremely bitter. The formula is C₁₂H₁₄O₈. It is soluble in water, alcohol, and ether. The detection of this substance is important, as *Cocculus indicus*, on account of its intense bitterness, has been used as a substitute for hops in beer, and it is very poisonous. It is usually separated from solution by amylie alcohol, which dissolves it out, and the solution is allowed to evaporate; the crystals are again crystallized from alcohol, and recognized by the intense bitterness and by the power of reducing oxide of copper in alkaline solution. It is used in medicine in doses of one one-hundred and twentieth to one-twentieth of a grain in epilepsy and in chronic alcoholism. Overdoses cause delirium and convulsions.

PIC'TON, SIR THOMAS, G.C.B., a distinguished general, was the second son of John Picton, Esq., of Poyston in Pembrokeshire, at which place he was born in 1758. Having determinately chosen a military life, he obtained an ensigncy in the 12th Regiment of foot in 1771, and some six years afterwards he was promoted to a lieutenantcy. Becoming tired of the garrison duty at Malta, where his regiment was stationed, he exchanged into the 75th, in which he was gazetted captain. Five years afterwards, upon his regiment being disbanded, he retired on half-pay to Pembrokeshire, where he spent twelve years in the enjoyment of field sports, the study of classics, and in mastering the art of war. At the commencement of the war between England and France in 1793, after applying in vain for reappointment to active service, he went on his own responsibility to the West Indies, with the hope of receiving a commission from Sir John Vaughan, who was the commander-in-chief of that station, and through whom his desires were realized. Sir Ralph Abercromby coming out to replace Sir John Vaughan, Picton was afterwards superseded, but as volunteer aid-de-camp assisted Sir Ralph in the attack on St. Lucia, for which service he received a lieutenant-colonelcy, and in this capacity he was present at the battle of St. Vincent. At the close of the campaign he returned home with Abercromby, to accompany him back, however, in 1797 to the West Indies, when upon the reduction of Trinidad he was appointed its governor. In 1807 he was put upon his trial for ordering torture to be applied to a female slave in order to induce confession, and the jury found him guilty; but as many exaggerated rumours had preceded the colonel to England, a new trial was granted, by which he was acquitted of legal guilt. In 1809 he was at the siege of Flushing, and was appointed its governor, but driven thence by fever to England. Having recovered, he joined the army in the Peninsula, and in that season of awful bloodshed was associated with such historic names as Badajos, Ciudad-Rodrigo, and Vittoria, as the victorious leader of the "fighting division." On returning home at the end of the war he was invested with the order of the bath, received the thanks of Parliament, and was elevated to the rank of knight grand cross. But when Napoleon escaped from Elba, Picton was again found in full service. At the battle of Waterloo, 18th June, 1815, although two of his ribs had been broken by a cannon ball the preceding day at Quatre-Bras, he led the fifth division to that awful struggle with five times their number, in which his followers conquered while their leader fell. Monuments designed to perpetuate his fame have been erected in St. Paul's Cathedral and at Caermarthen.

PICTOR, FABIUS, a Roman family of the great Fabian gens, which gained its name from a certain Caius Fabius who painted a fresco on the walls of a temple about 802 B.C. This was so remarkable a feat among the in-artistic Romans that the adventurous Fabian was styled "the painter" thenceforward. The family of Fabius Pictor gave many consuls and other distinguished men to Rome; and one of its members, grandson of "the painter," Quintus Fabius Pictor, was the earliest writer of Roman history. He wrote, however, in Greek and exhausted his subject, beginning with the traditional landing of Æneas in Italy, and continuing down to the Gallic War (225 B.C.) and the second Punic War, in which he had taken part. His history was used and considered very valuable by subsequent writers, but no traces of it are now extant.

PICTS, the name given to a people who in early times inhabited the east and north-east districts of Scotland. Their territory was bounded on one side by the ridge of mountains stretching from Loch Lomond to the Frith of Tain, on the other by that part of Scotland which was subject to the Romans. The west of Scotland was held by the Celtic *Scoti* or Scots, who also inhabited the north-west of Ireland. The Scots were an Irish people, as their name implies, Scotia being the original name of Ireland, as Caledonia was of what we now call Scotland.

Few questions have been more keenly debated than that of the origin and history of the Picts. Their name does not occur in Ptolemy's enumeration of the British tribes in the beginning of the second century, nor is any notice taken of them under that appellation by Dion Cassius, Julius Caesar, Tacitus, or Herodian. This perhaps may be accounted for on the supposition that the name was applied to them from the prevalent custom of painting their bodies, an opinion supported by an expression in Claudian, "*nee falso nomine Pictos*;" the Romans probably giving the name *Picti*, in a kind of vague sense, to all the extra-provincial tribes who adhered to the custom of self-painting. It is more probable, however, that, according to the common Roman usage, *Picti* was a modified or Latinized form of the native name of the tribe—perhaps *Pictich*, the Gaelic for "plunderers," which would then be an honourable title in barbarian eyes.

The main points of dispute have been, whether the Picts were a Celtic or a Teutonic race, and what was the language they spoke. This question is emphatically an open one, since probably of all the Pictish language only four words are now in existence which can with certainty be vouched for as such; two of these are frequently united so as to form the compound word *Peanu-fahel*, the other two are *Cartoit* and *Scollofthes*. The compound word *Peanu-fahel* is found in the oldest MSS. of the Venerable Bede, and is used to signify the name of the place where the wall of Antoninus terminated on the east coast. Bede says the place is called *Peanu-fahel* in the Pictish language. *Cartoit* means "a pin," and *Scollofthes* is the Pictish name applied to the clerks of the church. In 1863 Sir James Y. Simpson showed to the Royal Society of Edinburgh a Pictish inscription on an elaborately-carved antique cross in the churchyard of St. Vigeans. Drust, one of the kings of the Picts, was, according to the annals of Tighernach, killed in 729 at the battle of Blathmig, about 2 miles from St. Vigeans. The inscription on the old sculptured stone is *Drasten ipe Voret elt Forcus*, and the reading of it is held by Sir James to be [the stone cross or stone] "of Drust, son of Voret, of the race of Forcus."

Later still, one of the manuscripts of the eleventh century, found among the relics of the monastery of Old Deir in Aberdeenshire, and preserved at the University of Cambridge, was discovered by the librarian of the university (Mr. Bradshaw, whose death in 1886 was universally lamented) to be in a Celtic tongue; and this is seized upon by those who maintain the Celtic race of the Picts as a

crowning proof. It is certain that it is more probable to be a Pictish than a Scotch document. It records "how Colunkill and Drostan came from Hi (Iona) to Aberdour, and how Bede the Pict, then Maormoirl (chief) of Buchan, gave them the towns of Aberdour and Deir," with the subsequent history of Deir. It remains at present the only certain record of the Celtic speech of Northern Scotland and of this early date.

The conversion of the Picts to Christianity is said to have taken place at different periods. Bede says the southern Picts received Christianity from Ninian early in the fifth century, whose labours were succeeded by those of Palladius, Serf, and others. The northern Picts were converted by St. Columba, who came from Ireland about the middle of the sixth century, in consequence of a feud between the leading clans of the royal race of that country. It is impossible to decide with certainty what was the precise nature of the Pictish religion before this period. The most probable supposition is, that it was a species of Druidism.

The Scottish and Irish chroniclers have given seven different lists of Pictish kings. These lists are all substantially the same, though in some minor points different. Brudeus, or as he is sometimes called, Bruidi, was king of the Picts when Columba arrived, and in no long time was converted to Christianity. His death occurred in 586. Shortly after this the two divisions were united in a common faith. The most energetic of all their kings was Hungus, who came to the throne in 730, and reigned thirty years. He may be pre-eminently designated the Warrior King, on account of his almost constant wars with the Britons, Scots, and English, and his almost invariable success. After his death it seems the kingdom of the Picts began to decline, and no portion of their history is involved in greater obscurity than the catastrophe, shortly afterwards, which appears to have put an end to their dominion in the north-east of Scotland. The common account is, that Kenneth, the Dalriadic or Scottish king, conquered the Pictish kingdom about 843, and united the whole of the North Britons into one monarchy. The most probable thing, however, is, that at the time of some disputed succession, Kenneth, who was (so tradition asserts) descended in the female line from the ancient Pictish kings, put forward his claims, was successful in the contest, and got possession of the throne of the Picts as well as that of the Scots, and henceforward ruled both nations. Neither the language, country, nor princes of the Picts were destroyed, but only became amalgamated with the Scots. The people and the language of the Picts disappeared by absorption into the common Picto-Scottish nation, the name Scot driving out the name Pict. The whole subject is still a thorny one, and no definite light has ever yet been shed upon it.

PI'CUS, a divinity worshipped by the early Latins, whose attributes were already obscure in historical times. He was a wood divinity, and either the husband or the lover of Pomona, with whom he is constantly coupled in representation. Traditional mythology would make him the first king of Italy, the son of Saturn, and the father of the wood-god Faunus. For resenting the advances of the sorceress Kirkê, he was changed into a woodpecker (*pikos*, Lat. *picus*), which bird was always held to have large prophetic gifts in antiquity.

PID'DOCK (*Pholas*) is a genus of molluscs belonging to the order LAMELLIBRANCHIATA, and family Pholadidae. These molluscs have the elongated cylindrical shell gaping at both ends, thin, white, brittle, exceedingly hard, and with the dorsal margin protected by accessory valves; the valves have no hinge teeth or ligament, but are beset in front with rasp-like calcareous processes. The animal is club-shaped, with a short, thick, projecting foot, and two large united siphons. These molluscs live in rocks

or clay, in holes which they excavate themselves. The exact method of boring employed is a matter of dispute, but it is probably by means of the rasp-like surface of the front of the valves; it has, however, been suggested that the sucker-like muscular foot, the surface of which can be constantly renewed as fast as it wears away, would be capable of excavating even hard rocks. These molluscs are also remarkable for their phosphorescence, a peculiarity which was known to Pliny. The species are tolerably numerous, and found almost all over the world. The common British species, *Pholas dactylus*, is used on the Devon coast as bait for fish. A West Indian species, *Pholas costata*, is used for food. The Ship Worm (*Teredo*) belongs to the same family.

PIE, an Indian coin. See **PIKE**.

PIECE OF EIGHT is a term often met with in our older books. It is simply another name for the Mexican silver dollar or piastre, whose worth in the old coinage was 8 reals, whence the name. It is from the design on this piece that the sign for the dollar (\$) is taken, which originally stood for a figure 8, through which two vertical strokes were drawn to signify the pillars of Herakles (coasts of Gibraltar and Tangiers), as symbols of Spain. Another name for the "pieces of 8," *pillar-dollars*, arose from the same device on the coin.

PIED MONT, PIEMONTE, or PIE DI MONTE means "a country at the foot of mountains," and is the old name of a district of North Italy which formed the central and metropolitan portion of Sardinia, but was merged in the kingdom of ITALY in 1861. It was in the eleventh century that the house of Savoy first gained a footing in Piedmont. The duke assumed the title of king in 1684, and shortly afterwards large additions were made to his territories. Driven out by the French in 1796, the house of Savoy recovered their territories by the treaty of Vienna.

PIEPOWDER COURT, an ancient court of record in England, once prevalent in every fair and market, of which the steward of the owner of the land was the judge. It was established for the purpose of administering justice in the case of commercial injuries done in that particular fair or market, and not in any preceding one; so that the injury must have been done, complained of, heard, and determined within the space of a day. This species of court, which was held in modern days only in the case of Bartholomew Fair, is now quite abolished. The name piepowder is a corruption of the French *piet poudreux*, and the court was sometimes known as the Court of Dusty Foot, its jurisdiction being generally confined to pedlars, &c.

PIER (from the French *pierrre*, stone), the general name for the solid spaces between a series of openings in a wall, whether windows or arches; but in its technical meaning it is more particularly applied to the pillar-like masses of masonry or brickwork supporting arches. The top of the pier, whence the arches spring, is called the impost, and generally consists of a series of moldings, although sometimes it is merely a platband, and occasionally it is omitted altogether, especially in rusticated basements. In many instances columns are substituted for piers, placed either singly or in pairs; and the arches spring either immediately from their capitals or from an entablature over them. There are again many examples in which both piers and a lesser order or suborder of columns are employed, the latter being insulated on each side of the pier, and their entablature forming the impost from which the arches spring. In Gothic architecture the piers of the nave are usually surrounded by light shafts so as to give the appearance of a cluster of slender pillars, and the clustered capitals of these shafts form the impost of the pier. The term pier is also applied in a special way to the solid masses supporting the arches of a bridge, with the exception of the extreme ones, which are distinguished by the name of abutments.

Pier is likewise the name given to a mole or jetty carried out into the sea, whether intended to serve as an embankment to protect vessels from the open sea, or merely as a landing-place.

PIERCE, FRANKLIN, fourteenth president of the United States, was born at Hillsborough, New Hampshire, 23rd November, 1804. He was educated at Bowdoin College, Brunswick, Maine, where he graduated in 1824, and where he formed an intimate friendship with Nathaniel Hawthorne, which continued through life. From college he proceeded to Amherst, where he studied law, and in 1827 he was called to the bar. Two years later he was elected to represent his native place in the state legislature, and in 1833 he was sent to Congress, where he showed himself an effective speaker and a good man of business. He was elected senator in 1837, but in 1842 was compelled to resign his seat and devote himself to the practice of his profession for the sake of his family. On the outbreak of the Mexican War he joined as a volunteer one of the companies raised in Concord, was soon after appointed colonel of the 9th Regiment, and returned home with the rank of brigadier-general. In 1852 he was put forward by the democrats as candidate for the office of president against his former commander General Scott, and elected by 254 votes against 42. His administration was

period of much political excitement, the most prominent events being the conclusion of a treaty for reciprocity of trade with the British colonies, the repeal of the Missouri Compromise, the arrangement of a treaty with Japan, and the resolute support given by the president and his ministers to the Fugitive Slave Act. The determination of the president to uphold slavery led to the difficulties in Kansas and Nebraska, which ultimately brought about the war of 1861-65. Pierce failed to secure re-election in 1856, and was succeeded by James Buchanan in March, 1857. His sympathies during the civil war were wholly with the Southern States, but he took no active part in politics after his retirement from the presidency. He died at Concord, 8th October, 1869.

PIERRE, BERNARDIN DE SAINT. See **SAINT-PIERRE**.

PIERS PLOWMAN, THE VISION OF. See **LANGLAND**.

PIETA, an Italian word signifying "piety," is the name given by artists to representations of the Virgin Mary embracing the dead body of her son. It is a counterpart to the Madonna with the infant Jesus in her arms. The Pietà expresses the utmost pain and grief, and the Madonna the purest joy and love. Many painters and sculptors have adopted this subject, one of the most notable representations being Michelangelo's marble statue in St. Peter's at Rome.

PIETERMARITZBURG, the chief town of Natal, South Africa, compounded of the names of the Boer leaders, Pieter Retief and Gert Maritz, is situated 51 miles north of Durban, on the highroad to the interior, on a tributary of the Umgeni River. It possesses three banks, a large military establishment, and several substantial public buildings, and has a population of 6700. It is built on a high plain, well supplied with water, and in summer is subject to violent thunderstorms, involving the necessity of a lightning-conductor to almost every house.

PIETISM is the name given to a religious movement which arose in Germany during the latter portion of the seventeenth century. After the struggle of the Reformation had resulted in the establishment of the Lutheran and Calvinistic churches, the spirit of life and freedom which had marked their rise gave way to a narrow dogmatism in doctrine, and to a system of church government under the pastors of a very rigid and formal character. In the controversies with Rome and with each other a polemical spirit had been encouraged among the Lutheran divines,

and so much of their strength was given to the definition and defence of doctrine that practical religion was neglected, and formalism took the place of piety. One of the first to protest against this declension was Johann Arndt, whose work on "True Christianity" (*Vom wahren Christenthum*), published in 1605, had a wide circulation, and exerted a great influence over the more devout members of the Lutheran Church. Another work of a similar character was the "Invitatio Fraternitatis Christi" of Johann Valentin Andrea, the court chaplain of the Landgrave of Hesse, which appeared in 1617; and the shortcomings of the church were still more powerfully exposed in the "Alarm Cry" of Theophilus Grossgebauer of Rosstock. The chief impulse, however, to the Pietist movement was given by Philip Jacob Spener, a Lutheran minister, who in 1666 commenced a series of special religious meetings in his own house, at which the study of the Scriptures and devout conversation were added to the ordinary devotional exercises. These meetings were soon imitated by others, and the attendants received the nickname of "Pietists," much in the same way as the term "Methodist" was given to Wesley and his friends at a later period in England. In 1675 Spener published his "Pia Desideria," or "Earnest Desires for a Reform of the True Evangelical Church," a work which produced a great impression throughout Germany, and in 1686 he was appointed to the court chaplaincy at Dresden, a position which enabled him to carry out some of the reforms he desired. Three years later some young *privat doctores* at Leipzig, of whom the chief was August Hermann Francke, commenced holding meetings which they called *collegia pietatis*, at which expository lectures on the Scriptures of a practical character were given, and which were largely attended by the students and townsmen. As usually happens, the jealousy of the established ecclesiastical authorities was aroused, the government was induced to interfere and suppress the meetings as disorderly conventicles, and Francke and his friends were compelled to leave the city. Francke repaired to Erfurt, but found there opposing influences of a similar character, before which he was quickly compelled to retire. By the influence of Spener, however, he was appointed to a professorship in the newly founded University of Halle, which from this period became the centre of German pietism. The aim of the Pietists was to restore the Bible to the place from which it had been dethroned by the dogmatic formularies of the church; to restore to the laity a larger share in its devotional exercises; to cultivate piety of heart and life rather than the science of theology; and to multiply works of instruction and charity. The leaders of the movement laid great stress upon the necessity of "conversion" and of separation from the world, and their doctrines upon these matters were exaggerated by some of their followers almost to the point of fanaticism, while they led naturally to the cultivation of a spirit of spiritual exclusiveness among the members of the little societies formed. The movement flourished as long as it had to encounter opposition, but as its opponents ceased their attacks it lost energy, and it began to decline as a distinct influence soon after the middle of the eighteenth century. It had, however, accomplished a good work, and its influence may be traced directly and indirectly in most of the religious developments of Germany which have succeeded it. At the close of the Napoleonic wars an effort was made by the German governments to revive the former influence of pietism as a means of protection against the revolutionary and anti-religious sentiments that had obtained the ascendancy in France, but the attempt failed, and the government support only tended to alienate the classes which it was most desired to gain.

PIETRA DURA, the name given to certain kinds of Florentine mosaic, wherein the inlaid materials are

hard stones (Ital. *pietra dura*), such as agate, amethyst, or cornelian. It appears to have been first introduced about 1550, and has almost always been confined to Florence. An atelier was established there as early as the beginning of the sixteenth century to supply the decorations of the Medici Chapel in the Church of San Lorenzo, and is still conducted under government superintendence. In this mosaic work, sometimes called *pietre commesse*, no colours are employed except those natural to the stone; and the varied tints and shadings are procured by a skilful employment of the gradations which the material itself affords. Marbles and jaspers, being necessarily very valuable, are only used in a thin veneer, about one-eighth of an inch thick. The stone is sawn by means of a fine wire stretched by a bow, aided with emery powder, and is worked down with emery at a wheel until it fits into the required pattern. It is then joined to the other pieces by being set in a backing of white cement, about half an inch thick. When the work is finished, this cement is planed down even, and a slab of slate put at the back. An inferior kind of *pietra dura* is now manufactured in Derbyshire and other parts of England.

PIEZOMETER (from Gr. *piezein*, to compress), an apparatus for measuring the compressibility of liquids. The essential principle of the cylindrical piezometer in general use is, that the liquid under examination being made to fill a vessel which is contained within the piezometer, and whose long neck descends into some mercury filling the bottom of the apparatus, the mercury is then pressed upon by water which lies above it in the piezometer, and is forced to a certain extent up the neck of the vessel, thereby compressing the liquid in question. The water in the piezometer is made to press upon the mercury by means of a piston forced into it by a powerful screw. The body of the piezometer is usually made of stout glass, that the reading of the compression may be visible; and the relative capacity of the neck and of the whole vessel in which is contained the liquid examined, has to be most accurately ascertained, and the neck gauged accordingly.

PIG (*Suidæ*) is one of the two recent families of the non-ruminant Artiodactyles, that is to say, the even-toed Ungulates, which do not chew the cud like sheep and oxen. This important family falls naturally into three groups, represented by the true Pigs or Swine, the WART HOG (*Phacocoærus*), and the PORCUPINE (*Dicotyles*) respectively.

The true Pigs or Swine (*Suidæ*) have four toes on both feet, the lateral ones scarcely touching the ground, and the metacarpal and metatarsal bones distinct. The Wild Boar (*Sus scrofa*) is the type of the subfamily. The dentition is that of a typical mammal, there being forty-four teeth in all, three incisors, one canine, four premolars and three molars on each side above and below. The canines of the male form long powerful tusks, the lower ones projecting beyond the upper lip. The head is long, and produced into a mobile truncated snout, which has a small bone at its extremity, and is used for rooting in the earth. The body is stout and muscular, measuring in the male upwards of 3 feet exclusive of the short tail. It is generally of a dusky-brown colour with black spots, and is clothed with coarse hairs, which form a kind of bristly mane on the neck and shoulders. The wild boar is an inhabitant of the forests of Europe, North Africa, and India, being absent from the more northern regions. It is now extinct in Britain, but as late as Norman times afforded sport to royal and noble sportsmen; according to Bell, Charles I. introduced some wild swine into the New Forest, but they were all destroyed during the Civil War. It is found in the vicinity of water, remaining under shelter in the daytime, and coming out at nightfall. Its food is chiefly vegetable, consisting of roots, &c., and in India it delights especially in the sugar-canes; but like the domestic pig it is practically omnivorous, devouring insects, snakes,

lizards, carcasses, &c. In India, "pig sticking" is a favourite sport among Anglo-Indians, though it is pursued with considerable danger, from the great strength of the boar, and the formidable tusks with which he is armed. The wild boar is usually hunted on horseback, the riders being armed with long spears, but such is the speed and desperate

courage of the quarry that he proves no mean antagonist for a party of resolute sportsmen. The domestic pig (see Hog) is descended from this species and another, *Sus indica*, which is not now found in the wild state.

The Bush Hogs (*Potamocheerus*) inhabit Africa south of the Sahara, and Madagascar. They are large animals,



Wild Boar (*Sus scrofa*).

distinguished by the presence of huge warty excrescences on either side of the muzzle below the eyes. The *BARY-RUSA* is found in the Malay Peninsula.

PIG-NUT is the tuberous root-stock of *Conopodium denudatum* (*Bunium flecuosum*, With.) This plant, one of the order Umbelliferae, is found in woods and pastures in the west of Europe, and is plentiful in Great Britain. The root-stock is nearly globular, of a black or chestnut colour on the outside, and white inside. It has an aromatic sweet taste, and is frequently dug up and eaten by children. Pigs are very fond of these nuts, and get fat when allowed to feed on them. When boiled they are a pleasant and nutritious food. Roasted they are preferred by some people to chestnuts, and are often in this country and on the Continent added to soup or broth. The annual stems are erect and slender, and the small white flowers are disposed in terminal compound umbels. The names pig-nuts and earth-nuts are also given to the tubers of an allied species, *Carum Bulbocastanum*, which occurs locally in England—in Hertford, Bedford, and Cambridge—in chalky fields.

PIGEON (Ital. *piccione* or *pipione*, Lat. *pipire*, to pipe or cheep) is the name applied to the birds of the order COLUMBAE. Pigeon and dove—the first of Norman, the latter of Saxon origin—are applied indifferently to the birds of this order. Two genera stand apart from the rest of the order, *Didus*, containing the extinct Dodo, and *Diuculcus*, containing the tooth-billed pigeon. The rest are usually considered to form one family, Columbidae. The species of this family are numerous, and are only absent from the most northerly regions; their home may be regarded as Southern Asia and the Malay Archipelago. They nest either in trees or in holes in rocks, breeding often several times a year. The eggs are whitish and always two in number, and both sexes share in incubation. The

young when hatched are helpless and blind for some days, during which time they are fed by the parents by a peculiar secretion analogous to the milk of mammals. This curd-like substance, the "soft food" of the pigeon-fancier, is secreted by the crops of both parents and disgorged into the mouths of their young, who thrust their little beaks into the mouths of the old birds. The wings are powerful, and the flight usually rapid and sustained, except in the ground pigeons (*Goura*). Their note is the well-known cooing, which is usually confined to the males at the breeding season.

The Common Pigeon or Rock Dove (*Columba livia*) is the origin of all the domestic varieties, some of which are noticed further on. In its wild state the rock pigeon inhabits caves and holes in rocks, never nesting in trees. On the coasts of England it is rare, but in Scotland and on the west coast of Ireland it is abundant. It extends as far north as the Farøe Islands, but is rare in Northern and Central Europe, though very common on the Mediterranean coasts. In Britain it breeds at least twice a year, the eggs hatching out in April and again in September. The two pure white eggs are deposited in a slight nest made of dried grass, seaweed, or heather. The rock pigeons devour considerable quantities of grains of barley and oats; but they also eat the seeds of noxious weeds, like the charlock. According to McGillivray they also feed on several species of snails. The total length to the end of the tail is 14 inches in the male, the female being half-an-inch shorter. The general colour of the plumage is slaty-blue, the sides of the neck shining with green and purple reflections; the lower back and rump are white; across the closed wings are two broad black bars; and the tail has a terminal black bar, lighter at the extreme tip.

The Ring Dove, Cuckoo, or Wood Pigeon (*Columba palumbus*), a common British species, is abundant through-

out Europe, extending to North Africa, Asia Minor, and Palestine. It is the largest European species, measuring 17 inches in total length. It is distinguished from the rock pigeon by the white patch on the neck and on the wings, by the reddish-purple colour of the neck and breast, and by the bluish-gray lower back and rump. The wood pigeon is found inland, nesting in trees, especially firs. The nest is rude, consisting usually of a few sticks laid across, on which two white eggs are placed. Three broods are not uncommon in the year. The wood pigeon has incurred the enmity of the farmer from the quantity of grain that it devours. These birds feed on green corn, young clover, grain of all kinds, peas, the berries of the holly and the yew, &c. In extenuation of their depredations it should be remembered that they also pick up the seeds of many noxious weeds. Individuals may be tamed, but the species is not capable of domestication like the rock dove.

The Stock Dove (*Columba oenas*) is another British wood pigeon. It derives its name from its habit of nesting in the stocks of trees, especially such as have been pollarded and become bushy at the top. By some of the older authors it was confounded with the rock pigeon, and the name stock dove then referred to its being considered the wild stock of our domestic breeds. Frequently no nest is made, the eggs being laid on the rotten wood in hollows of old decaying trees. In districts where trees are scarce it nests in rabbit-burrows or other sheltered holes in the ground. In many places where it breeds in holes in cliffs and rocks—as in the Undercliff of the Isle of Wight—it has been mistaken for the rock pigeon. The total length of the male of the stock dove is about 13½ inches. The general colour of the plumage is bluish-gray, with the sides of the neck golden-green; the breast is purplish-red and the rump light bluish-gray; the outer web of some of the tertiaries and of some of their coverts has a dark spot, which, however, does not form a band, as in the rock pigeon. In its habits it resembles the ring dove, but its note is less distinct and less prolonged. In its general distribution it also agrees with that species, but in Britain is most abundant in the southern counties.

In North America there are several species of the genus *Columba*, as the Band-tailed Pigeon (*Columba fuscata*), about 15 inches in length, found from the Rocky Mountains to the Pacific, and as far south as Mexico; and the White-headed Pigeon (*Columba leucocephala*), a little smaller, abundant in the West Indies, and migrating to the Keys of Florida in summer.

The Wild or Passenger Pigeon (*Ectopistes migratorius*), abundant in North America, has been several times shot in Britain. The only British species still unnoticed is the Turtle Dove (*Turtur communis*), which will be treated under that heading.

The foreign species of pigeons are too numerous for mention. The Fruit Pigeons (Carpophaga), inhabiting the tropics of the Old World, are remarkable for the beauty of their plumage. The Tree Pigeons (Ptilonopus and Treron) are also beautiful birds, inhabiting the forests of Southern Asia, Australia, and Africa. The Ground Pigeons (*Goura* and *Caloenas*), found chiefly in the Malay Archipelago and the West Indies, are adapted for progression on the ground. To this group belong the Nicobar Pigeon (*Caloenas nicobarica*), with its beautiful metallic-green plumage, and the magnificent Crowned Pigeon (*Goura coronata*). See FRUIT PIGEON; *GOURA*.

The wild Rock Pigeon (*Columba livia*), above mentioned, is the origin of all our domestic varieties. Pigeons have been domesticated for thousands of years, and the Romans seem to have been ardent pigeon-fanciers, giving, according to Pliny, immense sums of money for them and paying great attention to their pedigree. As a result of this artificial selection by man for so many generations, numerous breeds have been established, so distinct from one an-

other that, as Darwin says, some of them, if wild birds, would be classed by ornithologists in different genera. They all breed freely with one another, and the mongrel offspring is perfectly fertile. Both in pure breeds, and when one breed is crossed with another, there is sometimes a reversion to the colour and characteristic markings of the wild rock pigeon. The origin and characters of the different breeds were especially studied by Darwin in connection with the question of natural selection ("Origin of Species," sixth edition; "Animals and Plants under Domestication," second edition, i. 137-235). A slight mention of the better known breeds is all that is possible here; the amateur pigeon-fancier should consult the following work:—"Pigeons: their structure, varieties, habits, and management," by W. B. Tegetmeier (London, 1873). The Pouter is a large bird with very long legs and the power of inflating its crop to an enormous extent. The Tumbler is small with small legs and beak, and the extraordinary habit of tumbling over backwards in its flight. The Fantail is remarkable for the increase in the number of the tail-feathers, which can be spread out in a fan-like shape, and also for a peculiar trembling movement of the neck. The Trumpeter and the Laugher are so-called from peculiarities in their voice. The Carrier is a large pigeon with a long bill, the base of which is covered with a large warty wattle. It must not be confused with the Homing Pigeons, which are remarkable for their powers of flight and their attachment to their home; these, and not the carrier pigeons, are alone employed in carrying messages. Of homing pigeons the Belgian birds, called in England Antwerps, are the most esteemed. One of these birds will fly 500 miles in 12 hours if the sky be clear and the wind favourable. During the siege of Paris by the Germans in 1870, pigeons were employed in carrying messages to and from the beleaguered city with considerable success. Since then the military authorities of several of the European States have enrolled the pigeon, the universal type of peace, among the engines of warfare.

PIGEON PEA. See CAJANUS.

PIGMENTS or PAINTERS' COLOURS are those mineral or vegetable coloured matters which we use for decorative purposes, to impart the charm of colour to surfaces we wish to enrich, such as those of our houses or walls, or those of our garments or books; or which the painter uses for the purpose of imitating the colours of nature. It was early found that a little "vehicle" or "medium" of some simple kind of gum or glue would fix a coloured powder to the surface of a wall, &c., and so make permanent the adornment by some earth rubbed upon it, &c., which otherwise needed frequent renewal—this was *tempera* painting; or else the colours simply ground in water were applied to a fresh (*fresco*) surface of plaster, and were greedily absorbed, so that the surface plaster was completely and permanently stained—this was the art of *fresco*. The art of painting in oil was much later, but is now the favourite method of applying pigments, because of its greater facility and its greater permanency. Oils of various kinds are used, according to the varying nature of the work. For the decoration and protection of the woodwork and ironwork of houses, &c., linseed oil well boiled with litharge, or the sugar of lead, or sulphate of zinc, is the best. It should turn out after boiling quite clear and bright, and to this end it is usually filtered and otherwise clarified. The pigment, in a fine powder, is now mixed to a thick paste with boiled oil and white or red lead, other pigments being added to modify the tint as desired. When it is required for use it is thinned down to a creamy consistence by the simple addition of more oil and of turpentine and other "driers." The office of the turpentine, &c., is to help the paint to dry after it has been applied with a brush (technically called a "tool") to the surface to be decorated. If the turpentine, &c., is in small quantity

the paint will dry slowly and finish with a bright surface; if in larger proportion the paint will dry quickly and finish with a dull or matt surface, technically called "flatted."

The principal pigment in oil colour is white lead, and the second is red lead; both of these being good colours in themselves, as well as the bases for all other colours. As white lead is very susceptible to deterioration by gas, a more permanent white is obtained from the oxide of zinc and the sulphate of baryta.

Beside the brickdust colour of red lead there is a fine series of animal reds obtained from the cochineal insect, and of vegetable reds obtained from madder, though they are somewhat fugitive. These "lakes," as they are termed, are all organic colours precipitated on alumina bases. A native Indian peroxide of iron gives Indian red, and an Italian variety gives Venetian red, while bisulphuret of mercury yields the true vermilion; chrome red is another useful colour—it is a chromate of lead.

The finest blue is ultramarine, which is made by the calcined *lapis lazuli*, and is very costly. Cobalt (silicate of cobalt) is a very good substitute, and indigo and Prussian blue give other tints.

Yellows are chiefly obtained from the ochres, for the most part ferruginous aluminous earths (several of which when burnt yield varieties of red pigments). Yellow ochre, Oxford ochre, stone ochre, Indian ochre, and terra di Siena are some of the chief varieties. The fine (water colour) yellow called Indian yellow is made from canals' dung. Other yellows are Naples yellow, a compound of the oxides of lead and antimony, a rich opaque light golden colour, but rather treacherous, and therefore generally abandoned in favour of the similarly tinted chromate of lead or sulphuret of arsenic (king's yellow). The chromate of strontian yields a pale yellow, and the sulphuret of cadmium an orange yellow.

A mixture of yellow and blue pigments of like nature (either both mineral or both vegetable) is used to produce the various shades of green; while another large series is also obtained from several different salts of copper, and *terre verte*, a native mineral consisting of a combination of salts of iron, silica, potash, and magnesia. Green cinnabar is made from the sesquioxide of chromium, Prussian blue, and chrome yellow. The oxide of chromium is also used by itself as a green.

Browns are chiefly due to burnt pigments. Burnt sienna, burnt umber, burnt madder, burnt Prussian blue, burnt terre verte are all fine browns. Raw umber, a double oxide of iron and manganese, and asphaltum (a very treacherous colour) are other browns in general use.

The blacks are either lampblack, obtained by the burning of sooty or carbonaceous substances, varieties of animal charcoal, as bone-black, ivory black, &c., or of vegetable charcoal, as the blue black of carbonized vine twigs. The brownish-black pigment, very fine and even in texture, so much admired by water-colour painters under the name of Indian ink, is a variety of lampblack made by burning oil of sesame. Peroxide of manganese also yields a good black.

For artists' colours a similar mode of preparation is used, but fine linseed oil unboiled is the general medium in which the colours are ground. The diluent medium varies with different artists, some preferring mixtures of oil, some adding turpentine, some paraffin, &c.

PIKA. See CALLING HARE.

PIKE (*Esox*) is the sole genus of the *Esocidae*, a family of fishes belonging to the order *Pisces*. The pikes are characterized by having an elongated compressed body covered with small scales; no adipose fin; dorsal fin placed very far back over the anal fin; head elongated and depressed, without barbels; mouth very large, and the jaws furnished with strong teeth, smaller teeth being present in bands on the palatine bones and vomer; upper jaw

formed chiefly of the intermaxillary bones. There are about half a dozen species, all of which, with one exception, are confined to the fresh waters of North America. The Common Pike (*Esox lucius*) is the only species found in Europe and Northern Asia, but also occurs in the great North American lakes. The pike is now common in many of the rivers and lakes of Britain, though it has probably been introduced; even so late as the reign of Henry VIII. it was very rare, to judge from the price at which it sold. The Norfolk Broads have long been remarkable for their pike. When full grown the pike is 5 or even 6 feet long, and weighs 25 or 30 lbs. According to Yarrell the lakes in Scotland have produced very large pike, one from Loch Ken having weighed 61 lbs., and one from Loch Lomond 79 lbs. It is certainly the longest-lived and largest of fresh-water fishes, and grows with great rapidity. The pike prefers sluggish waters. It is strong and active, and is so remarkable for its voracity that it may be called the fresh-water shark. It will attack ducks, geese, water hens, and small mammals if within reach, and has been known to fight with the otter for its prey, and even to assault man himself. Its ordinary food consists of frogs and small fishes, even its own species not being spared. The colour of the head and upper part of the back is dusky olive brown, becoming lighter and mottled with green and yellow on the sides, and passing into silvery white on the belly; the paired fins are pale brown, the other fins brown, mottled with white, yellow, and dark green. The pike deposits its spawn among weeds in March or April. The flesh is well flavoured and easy of digestion, and is much esteemed; in the time of the first Edward the price, as regulated by law in consequence of its scarcity, was much higher than for that of salmon or turbot. The smaller pikes are preferred for the table. The pike is caught with rods and nets, but also by means of *liggers*, which are long cylindrical floats with strings attached to them. The young is called a jack or pickerel.

The Muscalonge or Maskinonge (*Esox nobilior*), from the great American lakes, is a large species, equalling or exceeding the size of the European pike. The other species are generally called pickerel. The Shovel-nosed Pickerel, the common pike of the Northern States (*Esox reticulatus*), a fish from 1 to 2 feet in length, is much esteemed for the table, and is caught all the year round.

PIKE-PERCH (*Lucioperca*) is a genus of fishes belonging to the perch family (*Perceidae*). The pike-perch shows considerable resemblance to a pike in its elongated body and large mouth armed with strong teeth. There are two dorsal fins, the first with from twelve to fourteen spines. The Zander (*Lucioperca sandra*) is common in the Danube, and is found in most of the rivers and lakes of Central Europe, though it is absent from the Rhine and its tributaries; it is not found in Italy, France, or Britain. It attains a weight of from 25 to 30 lbs., and a length of from 3 to 4 feet. It is highly esteemed for the table, and is also salted and smoked. Its introduction into British rivers has been urged, but its voracity is such that it would destroy great numbers of the other fish inhabiting the same waters. Two other species are found in the fresh waters of European and Asiatic Russia. *Lucioperca americana* and *Lucioperca canadensis* occur in the rivers and great lakes of North America.

PIKERMI, a village in Attica, between Athens and Marathon, rendered classical in geology through the researches of Professor Albert Gaudry of Paris. Near this spot is a deposit of the late *MIOCENE* or early *PLIOCENE* period, from which the French professor has disinterred innumerable remains of extinct quadrupeds. Among others there is evidence of the sabre-toothed tiger (*Machærodus*), of hyænas, monkeys, rhinoceroses, three-toed horses (*Hipparion*), large antelopes, giraffe-like animals, and extinct forms of elephants; and the whole assemblage affords the

most complete glimpse hitherto obtained of the animals that inhabited Europe during the epoch immediately preceding the present.

PIKES, FEAST OF, a name wherewith Carlyle has baptized the great ceremony of Federation, and the national oath sworn to the king, the law, and the nation, coupled with Talleyrand's blessing of the national flags of the eighty-three new-made departments of France, which took place in the Champs de Mars at Paris, on 14th July, 1790.

PILAS'TER, in classical architecture, a square pillar, usually attached to a wall, from which it projects one-fifth, one-fourth, or other definite proportion of its breadth. A pilaster usually carries its base and capital in the same way as the columns which it accompanies, or in whose stead it serves.

PILATE, PON'TIUS, the sixth Roman procurator of Judea, was appointed A.D. 25-6, in the twelfth year of Tiberius. He held the office for ten years. Pontius Pilate was of the rank of a Roman eques, and his name (Caius Pontius Pilatus) indicates that he was connected by descent or adoption with the gens of the Pontii, first rendered illustrious by the career of C. Pontius Telesinus the Samnite general. Soon after his appointment he removed the headquarters of the army from Cæsarea, the capital of the province, to Jerusalem, and the soldiers bore their eagles and the images of the emperor into the holy city. This aroused a storm of fanaticism among the Jews, and they assembled tumultuously round his palace at Cæsarea for five days, until he ordered the obnoxious symbols to be removed. At a later date he appropriated some of the temple funds for the purpose of completing an aqueduct, an act which led to a riot in which many were killed. In Luke xiii. 1 we have a reference to an act of tyranny not mentioned by any secular history, but which must have occurred at some feast at Jerusalem, probably in the outer court of the temple. It was customary for the governor of the province to reside at Jerusalem during the great feasts to preserve order, and hence it was that Pilate's name was made memorable to all time by his connection with the crucifixion of Jesus. We find from the Gospels that Pilate made repeated efforts to avoid passing sentence; when, however, the choice lay between having to suppress a serious disturbance or to deliver up an innocent man to an ignominious death, Pilate chose the latter course and gave Jesus into the hands of his enemies. Shortly afterwards his severity towards the Samaritans led to a complaint being lodged against him at Rome, and he was deprived of his office early in 36 A.D. His subsequent fate is uncertain. According to Eusebius he was banished to Vienna in Gaul, where, "wearied with misfortune," he committed suicide. Another spot claiming to have been that where the suicide took place is Mount Pilatus on the Lake of Luzern in Switzerland. Another tradition is to the effect that he was beheaded under Nero, while some legends of a later period speak of his suicide as being merely anticipatory of a death sentence passed upon him by Caligula. Several of the fathers assert that Pilate made an official report of the trial and condemnation of Jesus to Tiberius, but the "Epistolæ Pilati," now extant, are certainly spurious. The "Acta Pilati," which forms part of the "Evangelium Nicodemi," has already been noticed under GOSPELS, APOCRYPHAL.

PILAU, an Eastern dish composed of rice and a small quantity of animal food. The rice is boiled for twenty minutes, drained, and gently stirred with butter, pepper, and finely chopped onions. Some kind of meat, well boiled or roasted, is then placed on the top, and the pilau is complete. It is in very common use in India.

PIL'CHARD (*Clupea pilchardus*) is an important fish belonging to the same family (*CLUPEIDÆ*) and genus as the HERRING, from which it is distinguished by radiating ridges on the operculum. The pilchard is rather smaller

and thicker than the herring; the nose is short and turns up, the under jaw is shorter, the back more elevated, and the belly less sharp. The upper part of the body is bluish-green, and the belly and sides silvery-white. The pilchard is a southern form, found in the Mediterranean and many parts of the Atlantic, and appears in great numbers off the coasts of Cornwall. In the winter they keep near the bottom, but in the spring and early summer they enter shallower waters in great shoals for the purpose of spawning. On the Cornish coast, where they form an important article of commerce, the chief fishery is in August and September.

Pilchards are mostly caught by the process called seining; for this two or more nets are required. The chief or stop-seine is from 100 to 220 fathoms long, and from 8 to 10 fathoms deep, and has corks attached to one edge and leaden weights to the other. The boat containing the seine rows rapidly round the shoal, throwing out the net as it proceeds; and when the fish are thus inclosed as in a park, the net is drawn toward land till it is grounded and is then moored by anchors at several points, to keep it in its place and allow the fish to be taken out at leisure. The fish are gathered in a body into the edge by another net, the "tuck-seine," and are then lifted with baskets into boats. Drift-nets are sometimes used in the catching of pilchards, and a take of 50,000 by this means is not uncommon. The method of curing the pilchard is as follows: the fish, when boated ashore from the seine, are carried by women to the curing-houses, where they are "bulked" or piled up in heaps against the walls, first a layer of fish and then a layer of salt; this is done for the purpose of obtaining the oil with which the fish is largely impregnated, and which forms an article of commerce like the pilchard itself. At the end of thirty days bulk is broken, the great mass of fish is disturbed, and the salt is carefully collected by a process of sifting, in order that it may be again used. After the work of sifting out the salt has been gone through, the fish are carefully washed, and then packed in great barrels, in which holes have been made. The fish are pressed into the barrels by means of heavy weights, so as to get as many into the barrel as possible, and to squeeze out still more oil than has been obtained by the first process of bulking the fish. The pilchards are exported in great quantities to Spain and Italy, but few of them are smoked, although they are still called "fumades." Except in a fresh state, during the fishing season, the pilchards are little used in this country—nowhere, in fact, except in Cornwall and Devonshire. On the Mediterranean coasts this fish is called the sardine, and is largely exported preserved in oil, and the Cornish variety is sometimes treated in this way.

PILE, in engineering, is the name given to a beam of wood, usually elm, fir, or beech, having one end sharpened and shod with iron, used for making foundations, the walls of coffer-dams, piers, &c. In marshy or loose soils they are used in connection with buildings of all kinds, and in ordinary soils they are frequently employed when the foundations are laid of steeples, chimney shafts, or other more than usually heavy superstructures. The cities of Amsterdam and Stockholm are for the most part built upon pile foundations. When used for coffer-dams two rows of piles are generally driven into the ground, and the space between them is filled in with puddled clay. The water is then pumped out and the workmen are enabled to lay foundations for piers and bridges in the midst of rivers, lakes, or off the shores of the sea. Sometimes pointed, hollow cylinders of cast iron are used for piles instead of the beams of timber. Ordinary piles are driven into the ground by machines called *pile-drivers*, worked either by steam or manual labour, in which a heavy mass of iron, termed the *monkey* or *ram*, is raised to a height and then allowed to fall swiftly upon the head of the pile. Another

Kind of cast-iron pile which has been largely used of late years for the erection of beacons, estuary lighthouses, and piers, is the screw pile, invented by Mr. Mitchell, which is fitted with a screw point, the spiral of which terminates in a very broad heel or flange a short way up the stem. Piles of this kind are worked into the ground by a rotatory motion imparted by levers at the upper end. A figure of one of these piles and also of a beacon erected by their means will be found under LIGHTHOUSE. The iron pile invented by Dr. L. H. Potts in 1843, consists of a hollow tube of iron open at both ends, which is placed in position and allowed to sink into the ground as the sand and earth are drawn away from the interior by means of an air pump.

PILE-DWELLINGS. See LAKE-DWELLINGS.

PILES. See HÆMORRHOIDS.

PILGRIM is the name given to one who travels from devout motives to a shrine, tomb, or other sacred place, and the act itself is called a pilgrimage. The words *pilgrim* in English, *pellegrino* in Italian, *pelerin* in French, are all corruptions of the Latin *peregrinus*, which means a stranger or foreigner. The custom of making journeys to sacred places as a religious duty dates from prehistoric times, and it is one which prevails to-day among the greater portion of the human race. The first pilgrimages of which any trustworthy record has been preserved are those of ancient Egypt, and these, according to Herodotus, were arranged annually, and the more important of them were attended by enormous crowds of worshippers. The Phœnicians had also two great pilgrimages in honour of Ashtaroth, one to Aphaca and the other to Hierapolis in Syria, which were attended by votaries from all the Semitic races except the Jews. The temple at Aphaca long sustained an evil reputation on account of the impurity of its worship, and it was at last suppressed by Constantine the Great. The Jews in the early periods of their history appear to have made pilgrimages at regular intervals to a number of "high places," such as those of Bethel, Mizpeh, Dan, and Beersheba, but after the exile the local sanctuaries were abandoned in favour of the temple at Jerusalem. To the temple it was the duty of every true Israelite to resort on certain special occasions, and the precepts enjoining this duty are among the most positive and binding of the law. At the time of Jesus, when the Jewish nation, as at the present day, was widely dispersed throughout the civilized world, a number of worshippers, termed "standing men," were appointed to attend the temple to represent those who were unable to appear before Jehovah, and devout Israelites living in foreign countries were accustomed to make pilgrimages to Jerusalem when occasion permitted. In the Christian church the practice of making a pilgrimage to the Holy Land in order to visit sites of the localities rendered sacred by Jesus dates from a very early period, and it received an immense impetus from the celebrated pilgrimage of the Empress Helena in 326 or 328, which was rewarded by the discovery of a number of inestimable relics, among which was the wood of the Holy Cross. [See HELENA, ST.] Before the close of the fourth century the custom had become so firmly established that pilgrims flocked to Jerusalem from all parts of the world that had been reached by Christianity, and it is recorded that in the Holy City visitors might be found who had come from Armenia, Persia, India, Ethiopia, Gaul, and Britain, to worship at the Christian shrines there. The practice was continued without a check during the next two centuries, and after Jerusalem had fallen into the hands of the Mohammedans the liberty of transit for pilgrimage was granted by them in return for the payment of a stated tax. At a later period the fanaticism of the Mohammedans led them to oppress and hinder the pilgrims who resorted to Jerusalem, until Christendom was aroused, and armed pilgrimages on an extensive scale were organized. [See CRUSADES.] But Christian pilgrimages during the first

centuries were not limited to the Holy Land, for the honours paid to the martyrs and the preservation of their relics caused a number of sacred shrines to be set up in all Christian countries, to which pilgrims were accustomed to resort. Some of these relics obtained in addition to their sanctity a reputation for the working of miracles, and believers came from far and near in the hope of obtaining a cure for the diseases by which they were afflicted. In the course of time certain places gained high reputations as being centres of miraculous power, and as being the sites of alleged visions and supernatural discoveries. During the mediæval period, when pilgrimage was a common form of penance, each country had its own places of pious resort, though, as might be expected, special virtue was ascribed to a pilgrimage to Rome. At the latter city the great attraction was found in the shrines of St. Peter and St. Paul, but even these gave way to the claims of Loretto, which at the close of the thirteenth century was believed to have become miraculously possessed of the veritable home of the Holy Family. [See LORETTO.] Other places which possessed a high reputation for sanctity were the shrines of St. Jago de Compostella in Spain, of St. Gregory of Tours in France, the monastery of Einsiedeln in Switzerland, Mariazell in Austria, St. Andrews in Scotland, and the tomb of Becket at Canterbury in England. The institution of the Roman Jubilee, which perpetuated the custom of pilgrimages to Rome, is due to Boniface VIII. Pilgrims during the middle ages were expected to wear a special habit and to perform certain pious duties while on their journeys, and in return they were exempted from toll, were placed under the peculiar protection of the church, and were regarded as having a special claim on the hospitality of the monasteries and of good Christians generally. As a matter of fact, however, there is abundant evidence to prove that from a very early period pilgrimages became the occasion of great abuses; that they directly encouraged vagrancy, mendicancy, and debauchery; and that instead of leading to an increase of piety among those who took part in them, they very frequently caused serious moral deterioration. Some of the most biting of the satires of the Reformation period are those which are directed against the practice of pilgrimage, and it was given up altogether by those countries which adopted the Reformed doctrines. Even among Roman Catholics the practice gradually declined, and with the exception of certain districts where the people retained most of their primitive simplicity, it lost by degrees much of its former reputation. It received a fresh impetus during the pontificate of Pius IX., and the reported appearances of the Virgin Mary at La Salette and Lourdes in France attracted many thousands of pilgrims to those places. Much fervour was displayed during these visits, and numerous miracles were reported in the ecclesiastical journals, but the movement has declined since the death of Pius IX.

Pilgrimage forms an important element in the system of Mohammedanism, and according to the Koran every Mussulman who possibly can, ought once in his life to visit the Kaaba at Mecca. This annually draws from 70,000 to 80,000 pilgrims from the various Mohammedan countries of the world, of whom about a third perform in addition a pilgrimage to visit the tomb of the prophet at Medina. Like Christians the Mohammedans have a large number of shrines of lesser importance, the chief of which are the tomb and mosque of Imam Riza at Meshed in Khorasan; the tomb of Fatima, wife of Imam Riza, at Khoun in Irak Ajemi; and the tomb and mosque of Imam Hosein at Kerbela in Mesopotamia. Sacred places of minor importance, which attract pilgrims only from the surrounding districts, abound in all Mohammedan countries.

The Hindus also are greatly devoted to the practice of pilgrimage, and it is carried out on a more extensive scale in India than in any other country of the world. It has

been connected with Brahmanism from the earliest period, and when Buddhism was established as the state religion, pilgrimages to the chief scenes of Gautama Buddha's life became very common. Many Buddhist pilgrims still resort annually to Adam's Peak and the temple of Kandy in Ceylon, while the most celebrated of the pilgrimages of Brahmanism is that of Juggernaut on the coast of Orissa in Coromandel, which annually attracts an enormous concourse of worshippers. The regulation of the pilgrimages and the care of the pilgrims form not the least onerous of the duties devolving upon the British government.

PILGRIMAGE OF GRACE, the name given to a formidable insurrection in Yorkshire in the year 1536, provoked by the suppression of the lesser monasteries by Henry VIII. when he finally broke with Rome. The suppression of the greater monasteries, with the exclusion of all ecclesiastical peers but bishops from the House of Lords, was not till three years later, and although this second stroke has made more noise in the world, perhaps really the greater effect at the time was produced by the first stroke. The suppression of the lesser monasteries took place in February, 1536, and affected all houses with incomes of £200 and under, the ground of the act being the profligacy of the monks. There was indeed urgent need of reform, and Wolsey had already, some years before, set his hand to that work; but it may be well doubted whether the £30,000 of yearly revenue which was transferred to the crown by the edict of suppression, had not more to do with the matter in Henry's mind than the conduct of the monks. Besides, the king, who was an exceedingly clever man, foresaw that in his conflict with Rome, now finally decided upon, the monasteries would, if left alone, prove so many entrenched camps scattered throughout the country and in possession of the enemy.

The ruthless minister Thomas Cromwell, the one minister who ever sought to rule England by mere terror, espial, and bloodshed, carried out the king's church policy in a manner more tyrannous than perhaps Henry himself would have approved. The monks were, after all, the friends of the poor; the monasteries were the poor-houses, the "casual wards" of the sixteenth century. The people were therefore deeply hurt at the needless insults and cruelties inflicted on those who, whatever were their faults, had been kind to them. There were not wanting nobles to head the discontent, for Cromwell had risen from absolute obscurity to be the second in the kingdom, and was hated as an upstart. Louth in Lincolnshire rose first, on 2nd October; but soon from every parish of Yorkshire the farmers and their men marched, bearing the badge of the "five wounds," and with the parish priest, and often with the squire as well, at their head, converging upon York as a centre. The city surrendered to an overwhelming multitude (16th October). It needed not much over a week before one castle alone was left to stand for the king north of the Humber. Lords Dacre, Darcy, Hussey, Latimer, and Westmoreland, Robert Aske, and the Percys (except Northumberland himself, who opportunely fell sick) led the insurgents; and for the moment Dacre ruled the north of England, at the head of 80,000 men. He marched on Doncaster, 25th October. He summoned a Parliament at Pomfret (27th November), which debated and adopted certain demands upon the king as the price of peace. The chief of these were the reversal of the king's ecclesiastical policy, involving a reconciliation with Rome, the re-legitimation of the Catholic princess Mary, the restoration of the church property, and the death of Cromwell. Only 6000 men lay between Dacre and London. Cromwell saw his only chance, and opened negotiations through the Catholic Duke of Norfolk, promised in writing pardon to all, and a free Parliament at York, &c. (December, 1536). Upon this the insurgents disbanded, and Norfolk's army advanced on Yorkshire. A

few outbreaks in January, probably provoked with that intention, gave Cromwell the excuse for severity. The promises were flung aside with a sneer, and a fearful punishment fell upon all who had taken part in the Pilgrimage of Grace. Lords Darcy and Hussey went to the block; Sir Robert Constable was hung in chains at the gate of Hull; abbots were hung in pairs, side by side, both in Yorkshire and in London; even a woman, Lady Bulmer, was burnt at the stake. Whole districts were abandoned to devastation and pillage, and gibbets covered the north of England—seventy-four of them were counted at one time. A dreadful silence followed. England was cowed, and the tyranny of Henry and his reckless minister reigned supreme by the first days of February, 1537.

PILLAR, in architecture, is the general term for a supporting column; but whereas the word **COLUMN** always indicates a round pillar, the more general word includes every variety of shape. When a pillar is very massive it is called a **PYER**. The pillar of irregular (and usually of extremely beautiful) section is generally used as a support to arches in Gothic architecture in preference to the round column; and the clustering of smaller shafts round a pillar, or their insertion in hollows made for their reception, forms one of the most elegant and effective devices of this style.

PILLAR-SAINTS. See **STYLITES**.

PIL'LAU, a seaport in East Russia, with 4000 inhabitants, is situated at the extremity of a tongue of land between the Baltic and the Frische Haff. It is a place of considerable importance; for as the Haff is too shallow to allow large or heavily laden ships to go up to KÖNIGSBERG (25 miles) and Elbing, they are lightened of part of their cargo, or remain at Pillau, and the goods are conveyed to those ports by lighters, which also bring back the return cargoes. Near to the town there is a lighthouse, and a fortress which defends the entrance of the Haff. Pillau derives great advantages from its fisheries, especially of sturgeons, from the roes of which caviar is prepared.

PIL'LION, a woman's soft pad-saddle or second-saddle, with a suitable foot-rest, used in the old days when there were few roads and fewer carriages, and when horse-riding was the only alternative to walking. The lady who rode on the pillion held on by a firm strap belted round the waist of the man, who rode the horse in the usual manner, and behind whose saddle the pillion was fixed. The word itself is simply the Erse (Irish Gaelic) *pillium*, a pack-saddle, from *pill* or *peall*, a skin; the Latin equivalent for which is *pellis* (Gr. *pella*), a skin; seen in the English *fell* in the sense of hide. The word thus serves excellently as a proof of the intimate relationship between the main branches, Gaelic, Teutonic, and Classic, of the Indo-European family of languages.

PIL'LIWINK or **PYR'EWINK**, old names for the thumb-screw.

PILL'LORY. The pillory was a mode of punishment for crimes by a public exposure of the offender, used for many centuries in most of the countries in Europe under various names. In France it was called *pillorie*, and in more recent times *carcan*; and in Germany, *pranger*. The offences most frequently punished were forgery, perjury, libelling, &c. The English pillory was a wooden frame or screen, raised several feet from the ground, behind which the culprit stood, supported upon a platform, his head and arms being thrust through holes in the screen, so as to be exposed in front of it. Many persons died in the pillory through being struck with stones by the mob and pelted with rotten eggs and offal. It was abolished as a punishment in all cases except perjury in 1815, and was totally abolished in 1837.

PILLS are little balls composed of medicinal substances designed to be swallowed whole. The facility with which they are made and administered, their com-

parative tastelessness, their power of preserving their properties unimpaired, and their portability and cheapness have long rendered them the most frequently employed and most popular form of medicine. Some of the vegetable extracts administered in this way are usually prepared in the form of a paste, and may be formed into pills without any addition; but other medicines require the use of some adhesive material, termed an excipient, to convert them into pill masses. As a general rule all the constituents of a pill which can be pulverized should be reduced to fine powder before mixing them with the soft ingredients which enter into its composition, and these last, or the excipient, should be gradually added and the mixture triturated or beaten until it forms a perfectly homogeneous mass. The nature of the excipient should also be suited to that of the active ingredients, powdered liquorice or sugar being very good excipients for soft extracts, syrup, treacle, or honey for light vegetable powders, and conserve of roses or extract of liquorice for powders of a heavy nature. Other excipients are found in Castile soap, medicinal soft soap, bread crumbs, and (where the pills are to be taken immediately) mucilage. A little powdered liquorice root, wheat, flour, or starch, is commonly employed to prevent the pills adhering to each other, or to the fingers after they are made, and lycopodium is used for a similar purpose on the Continent. Formerly pills were made of the weight of 5 grains, but now they are usually made of a weight of 2 to 3 grains, small pills being more easily swallowed, and affording greater facilities for apportioning a proper dose of the medicine. To prevent their becoming dry and hard, as well as to render them more agreeable to the eye, and to prevent the taste of nauseous ingredients affecting the palate during deglutition, pills are sometimes coated with gold or silver leaf, with gelatin, syrup, or a thin film of albumen. When they are designed to pass unaltered through the stomach so as to act entirely upon the lower intestines, they are made up with alcohol and varnished with ethereal solution of tolu.

In spite of their small size and tastelessness, it often happens that patients find it difficult to swallow pills, their nervous repugnance being generally increased by their setting the wrong way to work when they make the attempt. It is well in such cases for the patient to avoid any violent effort to bolt his medicine, as he is as likely as not to close his throat by such an attempt; but if he will keep his head erect, or in the position ordinarily assumed when eating, and after placing the pill within his lips, take a drink of water, it will generally be swallowed without difficulty. Pills are usually taken at bed-time, but occasionally they are administered at regular recurring intervals throughout the day like fluid medicines. Where an aperient is required for daily use, it is often a good plan to take it after the principal meal of the day, as it then becomes mixed with the food and its ingredients act more gently upon the stomach and bowels than when the pill is taken fasting.

PILLWORT. See PILULARIA.

P'LOT. In many maritime countries the name of pilot is applied to a constant officer in a ship, who has the charge of the helm and the general direction of the ship's course; and also to a person who undertakes the special charge of navigating vessels in particular rivers, roads, or channels, or in entering and leaving ports, and who is intrusted with such charge independently of the captains or masters, in consequence of his peculiar acquaintance with the navigation within the limits to which his duty is restricted. By the laws of many maritime countries, taking a pilot to navigate a vessel on approaching port has been considered from early times to be obligatory on the master. Thus by the laws of Wisbury, which were promulgated in the twelfth century, and were incorporated

in the marine laws of most European countries, it was compulsory on the master to take a coast-pilot on board, though the merchant or master opposed it. ("Ordonnances de Wisbury," art. 44.) In this country, pilots are established at several ports for limited parts of the coast, who are appointed and regulated sometimes by Acts of Parliament, and sometimes by charters of incorporation; and in general the master of a vessel engaged in foreign trade must put his ship under the charge of such a pilot, both in his outward and homeward voyage, within the limits of every such establishment. Pilotage in the Thames and Medway, and along the coast, from Orfordness to the Isle of Wight, excepting the jurisdiction of the Cinque Ports, has been for several centuries under the management of the corporation of the Trinity House, and Acts of Parliament have been from time to time passed to regulate the Trinity House and Cinque Port pilots. All these regulations were reconsidered by Parliament in the year 1825, and the majority of them were consolidated in the statute 6 Geo. IV. c. 125, which contains also some general provisions respecting pilots in other parts of the kingdom. The 12 & 13 Viet. c. 88 enacts that masters and mates of ships, after undergoing such examination and receiving such certificate as the Act requires, may act as pilots, within the limits specified by such certificates, of the ships of which they are respectively masters or mates. The laws relating to pilots were again revised by the 16 & 17 Viet. c. 129, and all existing regulations on the subject were embodied in the Merchant Shipping Act of 1854 (17 & 18 Viet. c. 104).

PILOT FISH (*Naucrates*) is a genus of fishes belonging to the horse-mackerel family (*Carangidae*). It is distinguished by a long somewhat cylindrical body covered with small scales, a keel on each side of the tail, and the spinous dorsal fin composed of a few short free spines. The Pilot Fish (*Naucrates ductor*) is well known from its habit of accompanying ships and large fishes, especially sharks. It is found in all tropical and temperate seas, and has been occasionally taken on the southern coasts of England. This fish was probably the *pompilus* of the ancients, a fish held sacred for its services in pointing out the desired course to sailors. Its relations with the shark are probably of that mild form of parasitism called commensalism. The pilot fish accompanies the shark, not from affection, as is sometimes romantically supposed, but to feed on the parasitic crustaceans which beset its huge mesmate's body, as well as to pick up the small pieces of its food. In addition, the pilot fish obtains security against other fishes of prey in the proximity of the formidable shark, while at the same time the latter is too unwieldy to attack its nimble attendant. The pilot fish is about a foot in length, and is remarkable for the beauty of its colour, being of a silvery pale blue colour, marked with five dark blue broad vertical bars. The flesh is delicate and resembles that of the mackerel. It feeds on small fish. The young fish differ so much from the adult that they were formerly thought to constitute a distinct genus, *Nandorvus*.

PILOT WHALE. See CAALING WHALE.

PILPAY, a corruption of BIDPAI, is the name affixed to the earliest extant collection of fables. It is now impossible to determine the birthplace of the originals of these tales, but there can be no doubt that the collection which bears the name of Pilpay had its origin in India, where stories in which animals are introduced as speakers and actors have been current from a very early period. Several collections of such stories, in which moral principles and maxims of prudence are inculcated by example and precept, written in Sanskrit, are still in existence. The oldest of them, and evidently the parent stock of the Fables of Pilpay, is the work known in India under the name of the "Pancha Tantra," or the "Five Sections," so called from its being divided into five books. An

analytical account of this work was published by Mr. H. Wilson, in the *Transactions of the Royal Asiatic Society* (vol. i. pp. 155–200); but an abridgment of the “Pancha Tantra,” called the “Hitôpadêsa” or “Salutary Instruction,” has become more generally known in Europe than the great original work. Both the “Pancha Tantra” and the “Hitôpadêsa” consist of prose, intermingled with poetry: the stories are told in prose, but the narrative is constantly interrupted by sentences in verse, borrowed from the works of nearly all the celebrated poets that preceded the epoch of their composition. The names of the compilers of these works, as well as the exact epoch of their composition, are unknown, but from internal evidence it is supposed that they were compiled subsequently to the fifth century A.D. In the first book a passage of an astronomical work by Varâhamihra is cited, and as it is pretty well ascertained that he wrote during the latter half of the fifth century, it follows that the Pancha Tantra must have been composed subsequently to that epoch. According to an ancient tradition, these celebrated fables were translated into the Pehlvi language by Barzûyeh, physician to Nushirvan, the king of Persia, who reigned between 531 and 579 A.D. In common with most of the literature of ancient Persia, this version has long been lost, but it is said to have been translated into Arabic during the reign of the Caliph Almansur (754–775), by Abdallah-ibn-Almokaffa, and through this channel these fables subsequently found their way to nearly every nation of Western Asia and of Europe. The Arabic translation is in the East usually called “The Book of Calilah and Dimnah,” in allusion to the names of two jackals which act a conspicuous part in the first story, and which we recognize in the Sanskrit original under the forms *Caractacus* and *Danuvana*. The wise man who is the story-teller is in the Arabic version termed *Bidpai*; in the Sanskrit original no name similar to this occurs; but it is certain that the name *Pilpay*, by which the work was till lately most generally known in Europe is, as we have stated, a corruption of *Bidpai*. From the Arabic text there are several translations into modern Persian. The most exact and complete Persian version is that by the celebrated vizir Abulfazl named “Ayâr-i-Dânish.” The Turkish version is from an earlier Persian translation, named “Anwâr-i-Soheli.” The earliest translation of the Arabic version into a European language is the Greek version by Simeon, son of Seth, who lived towards the close of the eleventh century.

The Indian stories first became known to most of the nations of Europe through a translation from the Arabic into Hebrew, made by Rabbi Joël, a learned Jew. The Hebrew text of Rabbi Joël was, in the thirteenth century, turned into Latin by Johannes de Capua, a converted Jew, who dedicated his translation to his protector, the Cardinal Matthew de' Rossi (Matthæus de Rubcis). It has been printed once, without date, but probably in 1480. This Latin interpretation was again translated into Spanish by Maestre Padriquo Aleman de Basilea, under the title “Exemplario contra los Engaños y Peligros del Mundo” (printed at Burgos, 1498, fol.), and into German by Count Eberhard of Württemberg, under the title “Beispiele der Weisheit von Geschlecht zu Geschlecht” (printed at Ulm, 1483).

In addition to these translations, the fables have also been found rendered into the Malay, Mongol, and Afghan languages, and it is believed that there is no other work except the Bible of which so many versions have been made. In their composition the fables bear unmistakably the stamp of their origin. “The animals, the scenery, and the aspect of society are all genuinely Indian, and not a few features image vividly the ancient state of Indian greatness and independence.” Among the tales found in the collection which are not properly fables, are the

originals of the Arabian Alnaschar, of the story of the faithful dog versified in Bethgelert, and of several of the French *fabliaux*.

(See “Mémoire Historique sur le Livre intitulé Calilah et Dimnah,” prefixed to Baron de Sacy's edition of the Arabic text of the Fables of Bidpai, Paris, 1816, 4to, and the dissertations on the same subject, and by the same authors, in vols. ix. and x. of the “Notices et Extraits des MSS. de la Bibliothèque du Roi;” II. H. Wilson's “Analytical Account of the Pancha Tantra,” in the *Transactions of the Royal Asiatic Society*, vol. i. p. 155; Wolff, “Bidpai's Fabeln,” 1837; Benfey, “Pancha Tantra,” 1859.)

PIL'SEN, a well-built fortified town in Bohemia, is situated in a beautiful and extensive valley at the conflux of the Bradawka and the Mies, at a distance of 52 miles south-west from Prague, and has about 15,000 inhabitants. The most remarkable public buildings are—the fine Gothic Church of St. Bartholomew, the gymnasium, the town-hall, and the house of the Tentonic Knights. Pilsen has considerable manufactures of beer, cloth, and morocco leather. The inhabitants trade in the productions and manufactures of Bohemia, and in cattle, iron, potash, feathers, wool, leather, cloth, &c.

PILULARIA is a genus of plants belonging to the group RHIZOCARPEÆ and order Marsilaceæ. One species, *Pilularia globulifera* (the pillwort or pepper grass) is a native of Europe, and is found in Great Britain on the extreme margin of ponds or on swampy ground covered with water during the winter and comparatively dry in the summer. It is very rare in Ireland. The pillwort, the only British rhizocarp, has a slender stem which creeps under water, rooting at every node, and giving off on the upper side setaceous quill-shaped leaves. The sexual organs are contained in pill-shaped receptacles.

PIMARIC ACID is an acid resin found in the turpentine from *Pinus maritima*, natural order Conifera; this body hardens in the air and is known in commerce as galipot. It crystallizes in white six-sided prisms; melting at 125° C. (257° Fahr.) The formula is C₂₀H₃₀O₂. It is insoluble in water, but very soluble in alcohol. It forms salts known as pimarates, and mostly soluble.

PIMENTO, a well-known spice, is the produce of *Eugenia Pimento*, a tree native of the West Indies. It is cultivated almost exclusively in Jamaica, and thence called Jamaica pepper. It is also known as *Allspice*, from the fancied resemblance of its odour and flavour to a mixture of cinnamon, cloves, and nutmeg. The ripe two-seeded berries, which are about the size of a pea, are dried by frequent turning in the sun, by which their colour is changed from green to brown or grayish-brown. The shell is very brittle, about the thickness of a card, and incloses two seeds, which are roundish, dark brown, somewhat shining, and have a weak aromatic taste. The shell possesses an agreeable clove-like taste and smell. Two kinds are met with in commerce, English and Spanish, of which the former is the better. A volatile oil is obtained from it by distillation. Pimento is employed in medicine chiefly to disguise the taste of nauseous drugs, but its principal use is in the seasoning of soups and other dishes. The oil is used in perfuming soap.

The returns from a pimento walk, in a favourable season, are prodigious. A single tree has been known to yield 150 lbs. of the raw fruit, or 112 lbs. of the dried berries. The annual exports are over 6,000,000 lbs., about two-thirds of which are sent to England. See *EUGENIA*.

PIMPERNEL (*Anagallis*) is a genus of plants of the order PRIMULACEÆ. The Common or Scarlet Pimpernel (*Anagallis arvensis*) is a common annual weed found in cornfields, gardens, &c., in England and all over Europe. The solitary axillary flowers are wheel-shaped, usually of a bright red colour, but sometimes white, with a pink eye.

A variety with bright blue flowers, which is considered by some a distinct species, under the name *Anagallis cerulea*, is rare in England, but common in Central and Southern Europe. The pimpernel is often called the shepherd's or poor man's hour-glass: it opens its flowers every morning about ten minutes past seven in these latitudes, and closes them a few minutes after two. If rain falls, or the air is charged with moisture, the flowers do not open at all. The Bog Pimpernel (*Anagallis tenella*) is a small creeping perennial, with pale pink funnel-shaped flowers. It is found in bogs and by the banks of rivulets in many parts of Western Europe: in Britain it occurs chiefly in the western counties of England and Scotland, and in Ireland. The Water Pimpernel (*Samolus Valerandi*), or brook-weed, is a nearly allied British species.

PIN, a small pointed instrument, usually of metal fitted with a head, and used chiefly for fastening cloth, paper, or other similar materials. Probably the first form of this instrument was the natural thorn, which is still used in primitive countries; but the use of metal pins can be traced back to the most remote antiquity, bronze pins being frequently found among the relics of the bronze period. Pins made of iron wire are said to have been introduced into England about 1460, and in 1483 their importation was prohibited by statute. Brass pins were not used until imported from France by Catharine Howard, queen of Henry VIII. Pins continued to be imported into England from the Continent, especially from France, until about 1626, when a certain John Tilshy introduced the manufacture into Gloucestershire. They were afterwards made in large quantities at London, Bristol, and Birmingham, and the latter town is now the headquarters of the pin-making industry. Formerly pins were made in two pieces, a pointed shank and a head made of fine wire twisted round and secured to it, but these have been wholly superseded by solid-headed pins made from a single piece of wire. In the old manufacture all the operations, from the straightening of the wire to the sticking of the finished pins in paper, were performed by hand, at least fourteen persons being engaged in the process, and this circumstance was used by Adam Smith as affording a striking illustration of the benefits derived from a wise division of labour. This forcible illustration no longer applies, for pin-making, like other industries, has been subject to the scientific progress and improvement of the age, and it is now wholly performed by machinery. In 1817 a man named Seth Hunt applied for a patent for a machine for making pins in one entire piece; but his machine does not appear to have come into use, and it was not until 1824 that pin-making by machinery became a practical success. In that year an American engineer, Lemuel Wellman Wright, obtained a patent for making solid-headed pins by machinery, and his apparatus must be regarded as the parent form of the machinery used at the present day. In the pin-making machine as now used, wire of a suitable gauge is supplied from a coil wound round a reel, the machine itself automatically drawing in its supply of wire as it requires it. As the wire enters the machine it is straightened by passing through a series of straightening pins or studs set in a table, after passing which it is caught by a pair of lateral jaws, beyond which enough of the wire projects to form a pin-head. Between these jaws it is held for an instant, while a steel punch advances and compresses the projecting end of the metal by a die arrangement into the form of a head. At the same instant a knife descends and cuts off the proper length of wire for a single pin, and the headed pin-length then drops into a slit sufficiently wide to pass the wire through, but retain the head. Thus held, the projecting ends are pressed against a revolving fly-cut steel roller, along the face of which they pass, falling out at the extremity well-pointed pins, but of a dirty brassy

yellow colour. They are next purified by boiling in weak beer, and are then arranged in a steam jacketed copper pan, in layers alternating with layers of grained tin, covered with water, to which a certain proportion of argol (bitartrate of potash) is added, and boiled for several hours. When removed from this boiler, they are coated with a thin deposit of tin, and after being washed in clean water, and dried by revolving in a barrel with dry bran or sawdust, they are finally winnowed from these substances finished pins. Pins are now generally sold by weight, simply packed in small paper packets or boxes, but a certain proportion are "papered," i.e. stuck in rows upon sheets of paper folded and crimped for the purpose, the process being effected by automatic machines hardly less ingenious than the pin-making apparatus itself.

The black pins used to fasten mourning garments are made of iron wire, and after the making are immersed in black japan and dried upon a stove. Pins for entomological use are made from very slender wire, and gilt, those of the smallest size numbering nearly 4500 to the ounce. At the present day it is computed that over 50,000,000 pins are made daily in the United Kingdom, of which about 37,000,000 are produced in Birmingham; London, Stroud, and Dublin manufacturing the remainder between them. The weight of the brass and iron wire annually consumed for pins is estimated at about 1270 tons, of which one-eighth is iron wire.

PINA CLOTH, a fabric manufactured only in Manilla. It is made of the fibres of the pine-apple plant; and can only be produced in small pieces, because the threads both of warp and weft are single unspun fibres. It is very strong, and is used principally for ladies' pocket-handkerchiefs.

PINCH BECK is an alloy of zinc and copper, in which the proportions differ from those in brass; the zinc representing 9 parts to 48 of copper, instead of, as in brass, 1 part to 2. New pinchbeck, from its golden colour, was at one time much employed to imitate watch-cases and other articles usually made of gold.

PINDAR (Gr. *Pindaros*), the greatest lyric poet of ancient Greece, was born at Kunoskephaloi, a village near Thebes, about 518 B.C. The family to which he belonged were hereditary flute-players, and he himself appears at first to have been intended for that profession—one held in considerable respect at Thebes in those times. At least we are informed that his father began to teach him the flute, and discovering that he possessed talents which fitted him for something higher, placed him under Lasos of Hermione, who instructed him in lyric poetry. The famous Korinna of Tanagra, a lyric poetess who wrote in the Æolic dialect, was, however, in all probability the chief preceptress of Pindar. Plutarch distinctly tells us so, and informs us also that it was she who recommended the youthful poet to introduce mythical narratives into his odes as the proper business of that kind of composition—an advice he afterwards closely followed. At a very early age Pindar commenced the career that was destined to be so illustrious, as a composer of choral odes for special occasions. He several times as a youth contended for the prize for music with Korinna and with another Boeotian poetess Murtis, but at that time was usually unsuccessful. As he grew up he speedily reached the highest eminence, and throughout a protracted life he acquired and retained not merely wealth and fame, but the friendship of the greatest rulers in Greece and its various colonies. Honours were lavishly heaped upon him by cities, states, and tyrants; he received the franchise as a mark of reverence from Athens, Ægina, and Opus; and after his death his statue was erected at the former place. When Thebes, a century later, was destroyed by Alexander the Great, the king commanded Pindar's house to be carefully protected. Poetry has seldom during the poet's lifetime been so justly and so magnificently rewarded.

Pindar's death occurred about 439 B.C. Many of this great poet's works are lost, and the great majority of those we now possess belong to a single class—that of the Epiniian or triumphal odes, in which he celebrates the victories achieved at the various public games. But it is not improbable that dithyrambic poetry was the composition in which he peculiarly excelled, if we may draw a conclusion from the fact that Horace places the dithyramb first in his celebrated enumeration of the kinds of poetry cultivated by Pindar. His extant works are of a very high order of merit. The variety of metre in them is beyond expression rich and full of meaning. There is in them a vivid and opulent pictorialism, and an impetuous sweep of lyric energy, that stamp them at once as proceeding from the hand of a master. Truly has the last of these characteristics been portrayed by the great Roman poet in lines that glow themselves with something of Pindaric fire—

"Monte decurrens velut amula, imbres
Quem super notas altare ripas.
Fervet immensusque ruit profundo
Pindarus ore."

Doubtless the lofty dignity which so many are inclined to consider as essential to the highest kind of lyrical poetry, is often lowered to jocoseness; but it must be remembered that the Epiniian ode properly demanded the presence of both these features, and that without the merriment as well as the solemnity such poems might be deemed imperfect, since they were in their nature festal, besides being religious. On the whole, we may place the works of Pindar among the noblest specimens of lyric poetry which the world has ever seen, and find no undue exaggeration in the language which, with a pardonable egotism, he ventures to apply to himself in one of the most beautiful of his odes, "The divine bird of Jove." Few flights in the atmosphere of song are more eagle-like than those of the great Greek lyrist. One of the very few pieces of ancient Greek music which we possess is a setting of Pindar's first Pythian ode, "Golden lyre, treasure alike of Apollo and the violet-crowned Muses," which Beekh and other musical antiquaries would fain have us believe was the poet's own work. A particularly scholarly edition and complete commentary on the four great odes of Pindar appeared half in 1879, and half in 1883 at the University Press at Oxford, the work of Mr. C. A. M. Fennell. This fine work, which reflects the greatest credit on English scholarship, since Pindar is admittedly a difficult author, quite supersedes the excellent edition of Donaldson, of 1841.

PINDUS or PINDOS, a mountain range of European Turkey, commencing about 40° north, between Thessaly and Epirus, and passing south into Greece. The summits reach 6000 to 7000 feet. It is continued in a south-east direction to Cape Colonna, by a range which contains the celebrated heights of Parnassus, Helicon, and Citheron. The prevailing rocks of the chain are granite and limestone.

PINE (*Pinus*) is an extensive genus of conifers belonging to the group **ABETINÆÆ**, distinguished by their monocious flowers, by their persistent woody cone-scales being thickened at the apex, and by their evergreen, needle-shaped leaves growing in pairs or from three to five together, surrounded by a membranous sheath at their base; the ovules at the base of the woody cone-scales ripen into two winged nut-like seeds.

Pines are widely distributed in the northern and temperate regions. A few species are found within the tropics in Mexico and the West Indies, but none occur on the continent of Africa. In North America and Northern Europe they frequently form extensive forests. They grow in mountainous or exposed situations, and are usually noble trees. Many of the pines furnish valuable timber and other useful products, as turpentine, tar, resin, &c.

The Scotch Fir (*Pinus sylvestris*), the only pine indigenous to Britain, is the typical species of Europe, reaching as far south as the mountains of Spain, and extending eastward through Siberia to Kamtschatka. In Britain it is only found wild in the Highlands of Scotland, but formerly it extended down to the North of England, and also existed in Ireland. It has, however, been introduced in many parts of England, even far to the south, on sandy moors and commons, and has multiplied naturally with great rapidity. When growing in suitable soil and a favourable situation, the Scotch fir is a noble tree, from 70 to 120 feet in height. On poor soil at great elevations it becomes a mere shrub, and on some light sandy soil the wood greatly deteriorates in quality, becoming white and of small duration. A granitic soil seems most favourable for its growth. The timber, the real deal of carpenters, is highly valued for its durability and lightness. The heart-wood, which is very resinous, and of a reddish colour, is greatly used in ship-carpentry, and especially in joinery, from the facility with which it can be worked. Several varieties are prized for the quality of the timber, as the Braemar pine of Scotland and the Haggrau pine of Westphalia. Besides timber other economic products are yielded by the Scotch pine, as turpentine and tar. In Scandinavia a kind of bread is sometimes made in times of scarcity from the ground inner bark. In Germany and Sweden a substance called *waldwolle* (forest wool) is made from the fibres of the leaves, and used for textile purposes and for stuffing cushions. The inner bark is also used by fishermen for making ropes. The Scotch fir is attacked by numerous insects, some of which are very destructive. The larva of the pine-chafer (*Hylurgus piniperda*), a small beetle, is very destructive in plantations in rich soils and low situations, attacking the young shoots; and the bark and leaves suffer from the depredations of the larvæ of other insects.

Nearly allied to the Scotch pine, or according to some an alpine variety of it, is the Dwarf Pine (*Pinus Pumilio*), which is a large spreading bush or low tree, found on the Alps and Pyrenees. The young branches yield an oil which is applied outwardly in Germany for rheumatism, bruises, &c., as is also a fragrant resin that exudes largely from the buds, which is sold in Germany under the name of Hungarian Balsam.

The Corsican Pine (*Pinus Laricio*) is a noble tree from Corsica, Spain, Southern France, and the Mediterranean countries generally, attaining a height in some favourable localities of 150 feet. It grows faster than any other known species, and produces excellent timber, similar in quality to red deal, but more brittle and less elastic. The French use it extensively in shipbuilding. This tree grows well in this country in sheltered situations. In the South of France it has been found useful for planting on the drift sands of the Bay of Biscay.

The Black Pine (*Pinus austriaca*) is found among the rocks and precipices of Southern Austria, and derives its name from the peculiarly dark colour of the foliage. The most sterile soil is said to suit it. The timber is resinous and durable, and resists alternate dryness and moisture better even than the larch.

The Pallas or Seaside Pine (*Pinus Pallasiana* or *maritima*) is another Mediterranean species. The timber is of little value for carpentry, but much turpentine is obtained from it in the south of France.

The Pyrenean Pine (*Pinus pyrenaica*) is a majestic tree, with bright green foliage, from the mountains of Northern Spain, the Pyrenees, and elsewhere. The timber is of good quality, and largely used in the Spanish dockyards. In England it forms a very ornamental tree in plantations, for which purpose it is especially suitable from its hardiness and rapid growth.

The Pinaster or Cluster Pine (*Pinus Pinaster*) is a noble

species, inhabiting the most sterile sandy plains of France and Southern Europe, especially along the coast. Its timber is soft, light, coarse, and only fit for very common purposes; but it affords a large quantity of resin and tar, and is much consumed in the manufacture of lampblack. It is this species that has been so successfully employed in fixing the loose sand of the barren plains of some parts of France, and in England it has been largely planted along the sea-coasts.

The Stone Pine (*Pinus Pinet*) is a large tree with a spreading head, from the south of Europe and the Levant. The seeds, called *pignons* by the French, and *pinocchi* by the Italians, are large and nut-like, and eaten for dessert, or made into sweetmeats, &c. They do not ripen till the fourth year, and are kept in the cone till required, as the oil with which they abound soon becomes rancid. This tree has become naturalized in many warm countries, but in England it is bush-like, and rarely exceeds 15 feet in height. The timber is soft, and not very durable, but is fine-grained and easily worked.

The Aleppo Pine (*Pinus halepensis*), from the south of Europe and Syria, is a low, graceful tree of rapid growth, chiefly valued for its resinous products.

Of the North American species with leaves in pairs the best known is the Red Pine (*Pinus resinosa*), so called from the colour of its bark. This tree is a native of Canada and the northern parts of North America, Nova Scotia, and Newfoundland. It is a noble tree, attaining a height of 70 or 80 feet, and bearing a considerable resemblance to the Corsican pine. It is of quick growth, and succeeds best in dry sandy soil. The wood is fine-grained and resinous, and is highly esteemed in Canada for strength and durability, being especially employed in ship-building.

Nearly allied to the Red Pine is the Scrub, Gray, or Labrador Pine (*Pinus Banksiana*), which is a low, scrubby tree, usually only from 5 to 8 feet in height, with curious gray twisted cones. It extends further north than any other American pine, growing even among barren rocks. The timber seems to be of little value, except for the construction of canoes, for which its lightness and toughness render it well adapted.

The Jersey Pine (*Pinus inops*), found from New Jersey to Carolina, is a low tree, from 30 to 40 feet high, remarkable, as in the next species, for the violet colour of the young shoots. The timber is of little value, except for the tar it produces.

The Yellow Pine (*Pinus mitis*) is a fine tree, attaining a height of 70 feet, with the leaves sometimes in threes on the young shoots. It is common in the pine forests of North America, as far north as Connecticut and Massachusetts. Its timber is of great value for domestic and naval architecture, provided the sap-wood, which is very perishable, is first removed. It is regarded as a most durable timber in this country, being largely exported to England as New York pine or yellow deal.

Of the pines with three leaves in a sheath, none are native of Europe. The Frankincense or Loblolly Pine (*Pinus Teda*) acquires the height of 80 or 90 feet in the *pinelands* of the Southern States of North America, and often spreads over land impoverished by cultivation. It is not much known in England, where it seldom thrives. The timber is soft and perishable, but it yields a fragrant turpentine plentifully.

The Pitch Pine (*Pinus rigida*) is found in poor soil in most parts of the United States, even inhabiting salt-marshes overflowed by the sea. It has a thickish dark-coloured bark, and, in consequence of the number of its branches, an unusually knotted structure. The wood yields tar in abundance, but is coarse-grained and of inferior quality, so is largely used for fuel. When growing in swamps it has little or no heart-wood.

The Southern or Georgia Pitch Pine (*Pinus australis* or

palustris) is a native of Virginia and the neighbouring states of America to the south, where it acquires the height of from 60 to 70 feet, with a trunk from 15 to 18 inches in diameter for two-thirds of its length. It is remarkable for the length of its leaves, which sometimes measure as much as a foot. Its timber is of excellent quality, light, close-grained, and durable, and is extensively employed in shipbuilding, particularly for masts; it also yields abundance of tar and turpentine. It is unfortunate that this, the handsomest and the best of the North American pines, should be too tender for our climate, being rarely more than 10 or 12 feet high in England. The timber is largely exported to this country.

The Heavy-wooded Pine (*Pinus ponderosa*) is a lofty tree, sometimes attaining a height of 100 feet, from the north-west coast of North America. The timber of full-grown specimens is so heavy that it scarcely floats in water; it is very coarse, and not of much value. *Pinus Sabiniana*, the nut-pine of California, is a noble tree, sometimes attaining a height of 140 feet; its nut-like seeds are eaten by the Indians. The wood is white, soft, and not durable. *Pinus insignis*, another fine Californian species, is remarkable for the brilliant grass-green colour of its foliage. *Pinus canariensis* is a native of the mountains of Tenerife and Canary, where it forms large forests, and often acquires an enormous size. The timber is very resinous and durable. The species is too tender for England. The Long-leaved or Cheer Pine (*Pinus longifolia*) is a beautiful species, with long, slender, deep-green leaves, inhabiting the valley and lower hills of Nepal, and cultivated in other parts of India as an ornamental tree; it is rather too tender for the climate of England. The wood is tolerably durable, and yields abundance of resin. *Pinus Gerardiana*, another large Nepal species, has edible seeds.

Of the pines with five leaves in each tuft there is one European species, the Cembra or Swiss Stone Pine (*Pinus Cembra*). This species is a tree of considerable size, inhabiting the sides of mountains in Siberia, Tartary, Switzerland, and Italy. It is very ornamental and hardy, grows tolerably fast, and produces a fragrant, fine-grained, soft wood, well suited for carvers and turners. The seeds are large, edible, and yield a large quantity of oil of good quality.

The White or Weymouth Pine (*Pinus strobus*), abounding from Canada to Georgia, is a large and important species, attaining a height of 160 feet. It grows very fast, and produces the clean, soft, white, but perishable timber imported from America under the name of "pine." In Britain it is planted chiefly as an ornamental tree.

The Giant or Sugar Pine of California (*Pinus Lambertiana*) is a magnificent tree, attaining a height of 200 feet and a diameter of 20 feet or more. The wood is white and soft, and of little value; the resin which exudes from the trees, when they are partly burnt, acquires a sweetish taste, and is used by the natives as a substitute for sugar. The large, nut-like seeds are eaten, either roasted or pounded into coarse cakes.

The Bhotan Pine (*Pinus excelsa*), nearly allied to the Weymouth Pine, is a large tree, from 90 to 120 feet high, found on the mountains of Nepal. The wood is durable and very resinous. This species bears our climate well, and is largely planted as an ornamental tree.

About a dozen other species of pines, chiefly from Mexico, have been introduced into England. The names pine and deal are often extended to other valuable timber trees.

PINE GROSBEEK (*Pinicola enucleator*) is a species of the family FRINGILLIDÆ, nearly allied to the bullfinch. The pine grosbeak is a northern species, found in both hemispheres dwelling among the pine forests, and feeding upon fruits, seeds, and the buds of trees. It is a very rare occasional visitor to Britain. The length of this bird is about 8 inches, and the plumage of its upper surface

exhibits a mixture of grayish-black and red—the dark colour occupying the middle of each feather, and the red the border. The wing-coverts are edged and tipped with white; the head, throat, and breast are bright red, and the abdomen gray. In the female the red colour is replaced by a golden yellow, except on the back, which is dark slaty-gray. The pine grosbeak builds a beautiful nest, very like that of a bullfinch, on a low branch of a fir. It consists of a network of twigs, lined inside with roots or dry grass. The pine grosbeak is not uncommon in England as a cage-bird, the male having a rich melodious song.

PINEAL GLAND, or *Pineal Body*, a small conical body, usually slightly pink or ruddy in tint, and deriving its name from the fancied resemblance to a pine cone, which lies between the anterior pair of the *corpora quadrigemina* in the brain, and above the posterior commissure of the third ventricle. It is a portion of the gray matter of the brain, but receives a special investment of the *pia mater* or soft integument of the brain. It contains a cavity (*acervulus*) in which are always found some particles of calcareous matter. It is attached by two long peduncles to the upper and inner borders of the optic thalami. It is smaller in man than the corresponding structures in reptiles and birds. It is extremely small in the rabbits and some other rodents.

There is a curious interest attaching to the pineal gland, because some of the ancient philosophers regarded it as the seat of the soul.

PINE-APPLE is the fruit of *Ananassa sativa*, a plant belonging to the order *BROMELIACEÆ*, a native originally of Brazil, though now naturalized in the West Indies and the hotter regions of South America, Asia, and Africa. The pine-apple derives its name from its resemblance to the cones of the *PINE* and other species of the order *Coniferae*. It is a spurious fruit, consisting in reality of the whole inflorescence. A short flowering stem arises from the centre of a number of long serrated fibrous leaves, and bears a conical spike of flowers, surmounted by a crown of small spiny leaves. After flowering the whole spike enlarges, and the flowers and their bracts become succulent and consolidated into one mass. This was originally doubtless a provision for the dissemination of the seeds, as with other succulent spurious fruit; but in a state of high cultivation the seeds do not ripen, and the plant is propagated entirely by the crown of leaves and by suckers. The pine-apple was first introduced into Holland from South America, whence it was brought to this country in 1690 by the Earl of Portland. It was known, however, in England as a foreign fruit a few years earlier, for Evelyn mentions in his "Diary" having tasted it at the table of Charles II., and some are said to have been sent as a present to Cromwell during his protectorate. The pine-apple is now cultivated extensively for the European markets in the West Indian Islands and South America, and cheapness has greatly increased the consumption of this delicious fruit among all classes. In England it has been cultivated with great success, fruit being produced in hot-houses far superior in size and flavour to those grown in tropical countries. A pine-apple from 6 to 12 lbs. in weight is not uncommon, and sometimes one weighing 2 or 3 lbs. more is produced.

The soil for pine-apples requires to be rich. A fresh yellow loam, strong, but by no means of a binding nature, with which is mixed a quantity of cow-dung, will answer very well. It is very important that a perfect drainage be at all times maintained. Moisture is essential for the growth of the pine-apple, and a tropical heat must always be maintained. It was at one time usual to grow pine-apples in pots, but now they are frequently planted in beds, and in Devonshire excellent fruit is obtained from plants grown during the summer in the open air. Many varieties have been established in cultivation. See *Plate*.

PINEL, PHILIPPE, a distinguished French physician whose name deserves to be remembered on account of the ameliorations he effected in the treatment of the insane and imbecile, was born at the Château de Rascas, Saint-André Tarn, 20th April, 1745. He studied at Toulouse, where he took his doctor's degree in 1778, and in 1792 he became head-physician of the Bicêtre. Two years later he received the corresponding appointment at the Salpêtrière, where he commenced a class of clinical medicine, which he continued after his appointment to the chair of medical physics and hygiene, and subsequently that of pathology in the École de Médecine. He was the author of numerous medical works, of which the chief are his "Traité Médico-Philosophique de l'Aliénation Mentale" (1791), "La Nosographie Philosophique" (1798), and "La Médecine Clinique" (1802); but his fame chiefly rests upon his substitution of a gentle and humane treatment for the old barbarous methods formerly employed in dealing with lunatics. His system, though bitterly opposed at the time by the medical profession, in a few years became generally accepted throughout Europe. He died at Paris, 26th October, 1826.

PINES, ISLE OF, or **KUNIE**, in the Pacific Ocean, off the south-west extremity of New Caledonia. It is about 40 miles in circuit, and densely wooded, particularly with pine timber, to which it owes its name. Turtle are abundant. Area, 72 square miles; population, about 700. —Also an island 40 miles south of the west end of Cuba, West Indies, about 40 miles in length, east and west, by 30 broad, rising to 1600 feet above the sea. The soil is very fertile, and it has mines of silver, quicksilver, and iron. It is a dependency of Havana.

PINGUIC'ULA is a genus of plants belonging to the order *LENTIBULARIÆ*. The Common Butterwort (*Pinguicula vulgaris*) is an herb with a tuft of broad entire radical leaves, from the midst of which spring several slender stalks, each bearing a single drooping bluish-purple flower. The flower has a two-lipped corolla projecting at the base into a spur. This species is found in bogs and damp places, on wet rocks, &c., throughout Northern Europe and in Russian Asia. In Britain it occurs in the hilly districts in the west of England and Scotland, and also in Ireland. A variety with large deep purple flowers, the *Pinguicula grandiflora* of some, is found in the bogs of Kerry and the south-western part of Ireland generally, and also in a few places on the Continent. The Alpine Butterwort (*Pinguicula alpina*) is a smaller plant with smaller pale yellow flowers; it is an Alpine plant, and has only been found in Britain in the extreme north of Scotland. The Pale Butterwort (*Pinguicula lusitanica*) has even smaller flowers than the Alpine species, pale yellow tinged with lilac. It occurs in Western Europe, Ireland, Western Scotland, and is very frequent in Devonshire and Cornwall. The common name butterwort has reference to the greasy feel of the leaves, owing to an unctuous secretion; they are said to coagulate milk.

A great interest attaches to this plant, inasmuch as it forms one of the remarkable insectivorous, or more properly carnivorous plants. [See *INSECTIVOROUS PLANTS*.] The margins of the leaves are naturally incurved, but the presence of captured insects makes them curve inwards still further so as to imprison them. A figure of the common butterwort is shown in *Plate III.* to the article *LEAF*.

PINK (*Dianthus*) is a genus of plants belonging to the order *CARYOPHYLLÆÆ*. The genus includes annual and perennial herbs with opposite, narrow grass-like leaves, and flowers solitary or in clusters. The tubular calyx is five-toothed, with overlapping bracts at the base; the corolla consists of five free, long-stalked petals, either entire or divided; the stamens are ten; the ovary is one-celled, with two styles, ripening into a capsule which opens at the apex by four valves, and contains numerous seeds. There are

about seventy species, chiefly from Southern Europe, Northern and Southern Africa, and the temperate parts of Asia; only one species is found in the New World, on the north-west coast of North America. The pinks are generally showy and fragrant flowers, on which account they have long been cultivated in gardens.

The Clove Pink (*Dianthus Caryophyllus*) is the original of the carnation and the picrotee. It is a native of Southern Europe, growing usually on old castle walls, and was introduced into England probably by the Normans. It is a stout perennial, with long linear leaves and solitary flowers, which expand in July and August, and are of some shade of pink. This plant has given rise to numerous fragrant showy varieties, the chief of which are comprised under the terms picrotee and carnation, each including white, yellow, and every shade of red up to dark crimson. Carnations are flowers in which the colour is arranged in longitudinal streaks from the base of the petal to its edge: picrotees have the colour making the variegation confined to a narrow band along the edge of the petals. "Self-coloured" flowers are only of one hue. See next article.

The common garden pinks are derived from the Pheasant's Eye Pink (*Dianthus plumarius*), a Central European form, naturalized in some parts of the south of England. It is a small perennial, with leaves rough at the edges, and fragrant rose-purple flowers. The Sweet William (*Dianthus barbatus*), a very popular garden flower, is a native of parts of Central and Southern Europe, but has not been naturalized in England. It is remarkable for having its small variegated flowers crowded in dense clusters at the top of the stem. Though a perennial, it is usual to treat this plant as a biennial, as the blossom of the first year is finer than that produced later on. The Indian Pink (*Dianthus sinensis*) is another exotic species which has given rise to many varieties with showy scentless flowers.

Four wild species of pink occur in Britain. The Maiden Pink (*Dianthus deltoides*) is found in fields and banks in the south of Scotland and throughout England, except Cornwall: it is also absent from Ireland. It is a much-branched perennial, with solitary rose-coloured or white flowers, which are produced all the year round. The Cheddar Pink (*Dianthus caesius*), with large, fragrant rose-coloured flowers, is confined in Britain to the Cheddar rocks in Somersetshire, and is very local throughout Europe. The Deptford Pink (*Dianthus Armeria*), an annual, rather rare in England and Scotland, has red flowers with dark dots. *Dianthus proliifer*, an annual with small purplish flowers, occurs locally in gravelly pastures in a few places in the south and east of England. Both these latter species are distributed through Europe and Western Asia, and have been introduced into the United States.

Garden pinks are usually propagated by layering, or by cuttings from the young, leafy shoots. A rich, loamy soil is requisite to bring them to perfection.

PINK is the name often given to the colour rose-pink, a light, gentle, slightly bluish variety of the reds, because of its being the usual colour of the flower of the same name (as with "violet," "mauve," &c.). The pink (flower) derives its name from its pinked or fringed edges (Old English *pinken*, to pick or peck).

In painting pink is used as the generic term for various water-colour pigments, sometimes of a rosy hue (rose-pink), but far more often yellow or greenish-yellow, the common bond between which is that they are all precipitated upon chalk (or whiting, &c.) from some vegetable juice, such as saffron, aloes, &c. Presumably the first flower used for this purpose was the pink, whence the name. The chief varieties are *rose-pink*, the principal roseate variety; *Italian pink* (or yellow lake), a delicate greenish-yellow of great beauty and power; *brown pink*, and *Dutch pink*.

PIN-MONEY. Gifts by a husband to his wife for the purchase of apparel, ornaments for her person, or for

her private expenditure, are called pin-money; and such gifts may either be made during marriage, or, what is the more usual case, a sum of money for that purpose may be secured by the husband to his wife by settlement or by articles executed before the marriage. A provision for pin-money is not liable for the husband's debts, and the wife is entitled in all cases to such money, and to her savings out of it and things bought with it. In Scotland such a gift made after marriage is revocable. See also PARAPHERNALLIA.

PIN'NA is a genus of molluscs belonging to the order LAMELLIBRANCHIATA, and that section of it which, includes the oysters and mussels. The shell has two equal wedge-shaped valves; it attains a length of 2 feet, and is thin and brittle, with a nacreous lining. The foot is large and grooved, and secretes a powerful and very fine silky byssus, by which the animal is attached. The best known species is *Pinna nobilis*, found in the Mediterranean from low water to 60 fathoms. The silk of the byssus has for long been woven into articles of dress. It is thoroughly cleansed from all impurities by washing and combing, and then mixed with about one-third real silk and spun on the distaff. The prepared fabric is of a beautiful burnished golden hue, and is made into gloves, caps, &c. At the present day this manufacture is confined to Toronto, and the manufactured articles are rather costly. Rose-coloured pearls are often found within the shell, and these are due in many instances to the presence of a little pea-crab (*Pinnotheres*), which shelters itself in the mantle and gills of the mollusc as a mesmate. The story of the connection between the mollusc and the tiny crustacean is given by Pliny, with romantic embellishments. About thirty recent species of *Pinna* are known with a wide distribution; some are used for food. The fossil species are numerous, from the Devonian rocks downwards.

PINNACE, an Italian word (*pinaccia*, diminutive of *pinna*, a ship), was originally a small vessel, fully rigged, and used as a tender to a large one, for the purpose of communicating with the shore. The name *pinna* is now limited to a large boat carried by ships. It is larger than the cutter and smaller than the launch, and is rowed by from ten to sixteen oars. The term is falling into disuse in the British navy.

PINNACLE (Lat. *pinnaeulum*), in architecture, a small square or many-sided pillar or turret, generally attached to the angle of a building, terminating in a point like a pyramid, and occasionally enriched with foliage. It was much employed in Gothic architecture, and in the later styles was elaborately decorated, frequently with shafts bearing canopies, and niches either with or without statues. Pinnacles are generally used as a termination to battresses or the tops of gables, and then assume the form of spires, with crockets and a finial.

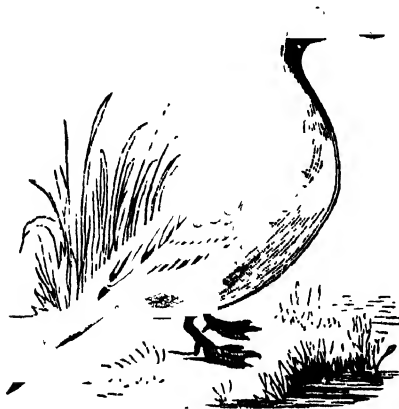
PINNATE, in botany, is the term applied to a compound leaf, which has its leaflets or pinnules arranged on each side of a common petiole.

PINNIPEDIA is a group of MAMMALIA containing the seals and walruses, and classed usually as a suborder of the Carnivora, though some make it a distinct order. These mammals have an elongated hairy body, adapted in form to their aquatic habits, and ending in a short conical tail. There are two pairs of limbs, the posterior pair being directed backwards; all the limbs end in broad, five-toed fin-like feet. The dentition resembles that of the land Carnivora, with which the Pinnipedia further agree in their zonyary placenta. There are only two families, Phocidæ (SEAL) and Trichechidæ (WALRUS).

PINT, the half of a quart, and the eighth part of a gallon, which is the standard measure connected with the pint. It is equivalent to 84·65925 cubic inches. The ancient pint, both English and Scotch, are derivatives from the Roman *sextarius*, so that the existing imperial meas-

ures, consciously or unconsciously, are reversions to older standards. The old Roman *sextar* is known to have contained twenty Roman or avoirdupois ounces of water. The pound of wheat, therefore, filled the *sextar* pint; the same wheat was the *bulk* of the pint and the *weight* of the pound. Thus, the cubic capacity of the old bushel holding 64 lbs. of wheat was made up of the bulk of 64 *sextar* pints, each containing 20 oz. of water. The present imperial gallon equals in bulk 10 lbs. of water. Ten pounds are equal to 160 oz., and, as the imperial gallon of 1826 was still to be divided into 8 pints, each pint was defined to hold 20 avoirdupois or old Roman ounces; so that the bushel of 64 pints, after many vicissitudes, returned in England precisely to its old dimensions. In Scotland it appears that the old measures are identical with the English imperial measures, having originated independently from the standards of imperial Rome. These calculations are well followed out in a curious little volume called "A Bushel of Corn" (A. Stephen Wilson, Edinburgh, 1884). See GALLON.

PIN-TAIL DUCK (*Pinula acuta*) is a species of Duck widely distributed through all the northern parts of the world, migrating southwards in winter. It is a regular visitant to Britain, occurring particularly on the coasts of Cornwall, Dorsetshire, and Hampshire, and in the fens of the eastern counties. The pintail duck is a slender, handsome bird, with a long pointed tail and a long slender neck. The length of the adult male is from 26 to 28 inches; the head and upper part of the neck are dark brown; the back and upper parts generally rich gray,



Pintail Duck (*Pinula acuta*.)

produced by fine undulating alternate lines of grayish-white and bluish-black; the lower parts are white; the sides are gray, and the elongated tail-feathers black. In July the male begins to lose its distinctive male plumage, and is at length only distinguished from the female by its size and the colour of its beak. After the autumnal moult the male plumage is gradually assumed again. The pintail duck often frequents inland ponds and lakes, nesting in rushes and feeding on such plants as the horsetail (*Equisetum*), insects and their larvae, and molluscs. Its flight is very rapid. The flesh is much esteemed for food.

PINTELLI, BACCIO, the architect of the Capella Sistina. He is supposed to have been a Florentine. In the pontificate of Sixtus IV. (1471-84) the Capella Sistina was built by Pintelli, being finished about 1478. This chapel architecturally is of little interest, but, as containing some of the greatest works of Italian painting, it is of considerable importance in the history of art. It is a simple rectangular oblong, with a vaulted roof, 132 feet

8 inches long, 43 feet wide, and 57 feet 10 inches high. Pintelli executed several other important works for the Pope, the greatest, next to the Sistine Chapel, being the Vatican Library (1478-75). Other considerable works are the well-known church beside the gates of Rome, Sta. Maria del Popolo, the Ponte Sisto, &c. He also very judiciously restored and strengthened the complex structure of the triple church at Assisi. He probably died at Urbino about 1495; in which town his last years were spent, labouring to complete the splendid palace of Duke Federigo.

PINTURIC'CHIO (BERNARDINO DI MARIO, called also *Bernardino di Betto*) was born at Perugia in 1454, and is one of the most distinguished of the Umbrian painters. He was the pupil and assistant of Perugino, worked completely in his style, and in some respects surpassed him. He early distinguished himself in Rome, in the Church of Santa Maria del Popolo, for which he painted the vault of the tribune, very rich in ornament. In 1502 Pinturicchio was employed on his great work, the painting of the library of the cathedral of Siena, for the Cardinal Piccolomini, afterwards Pope Pius III. Here he executed ten large frescos from the life of Aeneas Silvius Piccolomini (*Aeneas Sylvius*), who became Pope Pius II., in which he employed the young Raffaele as his assistant, owing to which circumstance, till quite lately, the chief merit of these really fine works has been unjustly attributed to Raffaele, though the frescos were not completed until 1509, years after Raffaele left Siena. Though a clever painter and an original observer, Pinturicchio never entered into the spirit of the cinquecento, and he is said latterly, like Perugino, to have neglected his work, painting rather for money than for credit, and trusting too much to pupils. He was one of the first to pay any great attention to landscape. He was an eccentric man, and in some way contrived to instil a bitter hatred into his wife Grania. She consigned him to a terrible death. She locked him up in his house at Siena alone, during an illness, and there left him to starve to death, 11th December, 1513. Many of his works are still preserved at Rome and elsewhere. In the cathedral at Spello is his own portrait signed "Bernardinus Pictoricius Peruginus, 1501." His father's name was Benedetto; Pinturicchio is simply a nickname signifying the "little painter." Four very good easel pictures by this artist are in the National Gallery, the best being the "Story of Griselda."

PIOMBO, SEBASTIANO DEL (SEBASTIANO LUCIANI), commonly known as *Frate del Piombo*, from his office of keeper of the Pope's leaden seals, was born in Venice in 1485. He was originally a musician, but influenced by the works of Giovanni Bellini and Giorgione, was led to follow painting as his profession, and he studied under both of those masters. About 1512 he was invited by Agostino Chigi, a rich merchant, to Rome, to aid in the decoration of his villa on the Tiber, afterwards known as the Farnesina. At Rome he made the friendship of Michelangelo, who has the credit of putting Fra Sebastiano forward as a rival of Raffaele. In 1519 he painted his masterpiece, the large picture of the "Raising of Lazarus," now in the National Gallery. It was completed for Giulio de Medici, then bishop of Narbonne, and afterwards Pope Clement VII.; and this picture was sent to Narbonne in the place of the "Transfiguration" by Raffaele, which had been originally destined for the cathedral there. The "Lazarus" is supposed to have been painted from a design by Michelangelo. However this may be it is certain that Michelangelo can have had nothing to do with the painting of the picture, as he left Rome shortly after Sebastiano commenced it, and did not return until years after it was completed, from 1513 to 1525. Clement VII. made Sebastiano the *Frate del Piombo*, i.e. of the Leaden Seal (Ital. *piombo*, lead), an office he held until his death in 1547; and after he enjoyed the emoluments of this office he became very idle. Its occupancy rendered it necessary to adopt the religious habit.

Sebastiano was a fine colourist and an excellent portrait painter. His picture of Andrea Doria in the Doria Palace at Rome is a grand example of portraiture. It is quite certain that some of the so-called Giorgiones are in reality due to the richly coloured pencil of Sebastiano.

PIOUS USES. See **USES**.

PIOZZI, HESTER LYNCH, was the daughter of John Salmsbury, Esq., of Bodvel in Carmarvonshire, where she was born 27th January, 1741. Her good looks and vivacity early acquired her distinction in the London world of fashion, which ended in her marriage, in 1763, to Mr. Henry Thrale, an opulent brewer in Southwark, and then one of the members for that borough. It was soon after she became Mrs. Thrale that her acquaintance with Dr. Johnson commenced, and during the next few years she gathered round her a brilliant circle, including Reynolds, Burke, Goldsmith, Garrick, and the Burneys. Thrale having died in 1781, his widow retired, with her four daughters, to Bath. She there married an Italian music-master, named Gabriel Piozzi, in 1784. A complete rupture with Johnson was the consequence. This did not prevent Mrs. Piozzi from publishing, in 1786, two years after the great doctor's death, an octavo volume of gossip, entitled "Anecdotes of Dr. Samuel Johnson, during the last Twenty Years of his Life." Many things in this publication gave great offence to Boswell and Johnson's other friends. Mrs. Piozzi followed up her first book by another, in 1788, entitled "Letters to and from Dr. Samuel Johnson," in two vols. 8vo. Mrs. Piozzi died at Clifton, near Bristol, 2nd May, 1821. ("Autobiography, Letters, and Literary Remains of Mrs. Piozzi," A. Hayward, 1861.)

PIP. See **POULTRY**.

PIPA. See **SURINAM TOMB**.

PIPE, a wine measure, usually containing 105 imperial or 126 wine gallons. Two pipes, or 210 imperial gallons, make a tun; but in practice the size of the pipe varies according to the description of wine it contains. According to modern usage a pipe is a cask of port wine (two hogsheds of sherry are called a butt), the standard measure of which is 115 gallons. It is to be observed, however, that the pipe is seldom accurately this measure, and it is usual to charge only what the vessel contains.

PIPE, in music. The simplicity of the pipe as the means of producing a musical sound makes it antecedently probable that it was the earliest musical instrument. In fact, much as men rejoiced over the little pipe with two finger holes found in the ruins of Babylon, and therefore of very ancient date (though it still blows as clear and true as when its former first baked the clay after fashioning it), its value as an antiquity is quite eclipsed by more recent finds in the prehistoric cave-remains of France, where, in the Dordogne district of Périgord, amidst relics of the mammoth, the cave-lion, and cave-bear, and the flint tools of cave-men, a small bone about two inches long was discovered, in which was a hole bored by a flint, converting the bone to a whistle or pipe. Afterwards more bone "pipes" were found, and now about half-a-dozen good specimens exist. This most ancient of all instruments is the first digital phalanx of a ruminant, drilled to a certain depth by a smooth cylindrical bore, on its lower surface, near the expanded upper articulation. On applying it to the lower lip and blowing into it a shrill sound is produced. Other pipes, with three holes, made out of a stag's horn, blown at the end like a *flûte-à-bec*, giving at least four sounds, are found in deposits of the stone age, which, though posterior to the age of the cave-men, is itself of vast and prehistoric antiquity.

Next to these, of relics absolutely in our possession and not merely known by sculptures, paintings, or descriptions, come either the Babylonian two-holed pipe, or perhaps more probably some of the Egyptian pipes. These latter are of reeds, and have three, four, five, and even more holes.

At least a dozen may be seen in the museum at Leyden, and there are several at the British Museum; one of the latter, about a foot long, having seven holes, evidently produced by burning. Two straws were found near it; and in other pipes straws have been found actually inserted; so that we may consider this as a rude attempt at a reed-pipe after the fashion of a clarinet, or rather, as there are two straws, of an oboe. The development of this pipe into the long Egyptian flute familiar to us in wall-paintings is of course obvious. It is observable that as *tibia* (leg-bone) was the Latin for trumpet, so *sibi* (leg-bone) was the Egyptian for flute; and this shows the bone-origin of the two instruments. To this day the "trumpet" of the Jews used by them to "blow a trumpet in the new moon" to open the year withal, is a ram's horn; and this *shofar* it was, according to tradition, before whose mighty blasts the walls of Jericho fell. Double pipes, once thought to be an invention of the Greeks, are now known to be not unfrequent in the wall-paintings of very early dynasties of Egypt; and many specimens of the original slabs of painted plaster from tombs, &c., will be found in the British Museum, containing figures playing this instrument (*nam*).

The double pipe is also more frequent in Assyrian sculptures than the single pipe. It is presumed that the object of the two pipes being blown by one performer was to produce a chord or harmony of two notes. But the fact of double pipes being in use in such ancient times as shown by these unimpeachable records drives back the invention of the single pipe to vast distances of time, corroborating the discoveries of "prehistoric" pipes previously referred to.

Many pipes are named in the Hebrew Bible. The *chalil* and *machol* are simple pipes, the first of them probably a reed pipe and the other a *flûte-à-bec*; the *maskrothia* is a double pipe; the *ugab* a syrinx or set of Pan's pipes (absurdly rendered by "organ" in Gen. iv. 21 in the Authorized Version, and corrected to "pipe" in the Revised Version), the *sumphonia* of Daniel and the *magrepha* of the Talmud, which is probably identical with it, a variety of bagpipe. There are also the trumpets of ram's horn, *keren* and *shofar*, and the silver trumpet with a bell mouth, made by Moses under divine direction, for sacred purposes, the *shatzzerah* (Numb. x. 2).

Very curious and ancient pipes have also been found in America, among which the most interesting are the *pitos* of the Aztecs, reddish clay pipes, with four holes, of the flageolet or whistle kind, ranging from 6 to 9 inches in length. The pito was the national and in some sort the sacred instrument. Every year at the festival in honour of Tezcatlepoza (the god of youth of the Aztecs, possessing also many attributes of the Greek Apollo) a human victim was offered up to the honour of the god. This was always a handsome and accomplished youth, prepared for the ceremony by the priests, who taught him among other things the sacred airs of the pipe. As he ascended the steps which formed the outside of the Aztec temples on his way to the altar upon the square summit, he played a pipe and then broke it on each of the steps in turn. The kings of the Aztecs began their prayers to the god with the phrase—"Breathe through me thy breath as through a pipe." In Peru, in Chili, in Guiana, and elsewhere, very ancient bone pipes are found, and it is alleged by early travellers that some of them were made by the natives out of the bones of their slain enemies (see Molina, *De Ovale*, &c.) The ancient Peruvians possessed the Pan's pipes also, and constructed them in stone as well as in reeds. A set containing fourteen pipes (reeds) is in the British Museum.

The higher varieties of pipes are found described in this work under the articles **PANDEAN PIPES**, **BAGPIPES**, **FLAGEOLET**, **FLUTE**, **RECORDER**, **CLARINET**, **OBOE**, **BASSOON**, **CONTRA-FAGOTTO**, **TRUMPET**, **HORN**, **TROMBONE**, **CORNET-À-PISTON**, &c.

PIPE FISH is the name given to a small group of marine fishes belonging to the order LOPHOBRANCHII, and forming with the SEA-HORSES (*Hippocampus*, &c.) the family Syngnathidae. In this family the body is elongated and slender, encased in a series of hard plates arranged in parallel rows. There is a single soft dorsal fin; the ventral fins are always absent, and the other fins are sometimes wanting. The jaws are elongated to form a tubular snout, at the extremity of which opens the small toothless mouth. The openings for the gills are very small, and are placed at the upper posterior angle of the gill-cover. The males have usually remarkable pouches situated on the ventral surface, either on the abdomen or the tail, in which the eggs are received and carried until they are hatched. The pipe fishes are distinguished from the sea-horse mainly by having the pouch open throughout its entire length, and by being without a prehensile tail. They are found throughout the world in temperate and tropical seas, and some enter fresh waters.

The Great Pipe Fish (*Syngnathus acus*) is frequently met with on British coasts in shallow water. It is usually between a foot and a foot and a half in length, of a pale brownish colour, with alternating darker bars. The dorsal fin and pectorals are small, and the caudal fin has the shape of a half-opened fan. It lives among seaweed, feeding on shrimps and small marine animals. The pouch is long, and situated on the tail; it is formed by two flaps of skin, which are sealed by a glutinous secretion after the eggs are received, and open again for their whole length when the young fish are hatched. Even after the young leave the pouch they return to it again on the appearance of danger, as do young marsupial mammals to the maternal pouch. The Broad-nosed Pipe Fish (*Siphonostoma typhle*) is another British species, being found on all the coasts of Europe. It is usually from 12 to 15 inches long, though, as in the case of the great pipe fish, considerably larger specimens have been taken. The colour is olive green, mottled with yellow. In the genus *Nerophis* the pouch is absent, the eggs being attached to the loose skin of the abdomen; the pectoral fins are wanting, and the tail tapers to a point. Three species of this genus are British, the Ocean Pipe Fish (*Nerophis aquoreus*), the Straight-nosed Pipe Fish (*Nerophis ophidion*), and the Little Pipe Fish (*Nerophis lumbriciformis*), the first-named being often found in great numbers in open seas, whither they have been carried by currents. The little pipe fish is only about 5 inches in length.

Numerous other species are known from all parts of the world.

PIPE ROLLS. See PIPE-OFFICE.

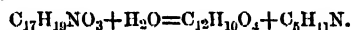
PIPECLAY, a fine clay found in Devonshire and Dorsetshire, and also in France, Belgium, and Germany. It is used in making white pottery and tobacco pipes. Pipeclay is of a light gray colour, and is quite free from iron and other impurities.

PIPE-OFFICE, or more properly the Office of the Clerk of the Pipe, a very ancient office in the Court of Exchequer, dating from the second of Henry II., was abolished with that of the comptroller of the pipe, by the Act 3 & 4 William IV. c. 99. The records of the office called Pipe Rolls were then transferred to the custody of the king's remembrancer. They are now in the Public Record Office, Chancery Lane.

As to the name of Pipe applied to this office and to the great roll of the exchequer, one conjecture is, that the rolls are so called because in form they resemble pipes. Lord Bacon, however, says, "The office is called of the Pipe, because the whole receipt of the court is finally conveyed into it by means of divers small pipes, as water is conveyed into a cistern." The duties of the clerks of the pipe were to make out crown accounts, draw crown leases, pass the sheriff's accounts, &c.

PIPERACEÆ is an order of plants belonging to the group MONOCHLAMYDEÆ. The pepperworts are shrubs or herbs, very rarely trees, with articular stems, and opposite, whorled, or alternate, simple entire leaves. The inconspicuous flowers are spicose or racemose, hermaphrodite, without a perianth, but supported on a bract; the stamens are, two to six, hypogynous, with the short filaments either free or adnate to the base of the ovary, and the anthers two-celled; the ovary is one-celled, with a solitary ovule, or composed of three to four more or less coherent carpels. The fruit is a dry or fleshy berry. About 1000 species have been described, widely distributed, especially abundant in tropical America and the West Indies. Most of them have aromatic properties. The pungent species, to which the name *PEPPER* properly belongs, are produced by species of the typical genus *Piper*.

PIPERINE, an alkaloid found in black pepper and long pepper (*Piper nigrum* and *Piper longum*), natural order Piperaceæ. It crystallizes in colourless prisms, having the formula $C_{17}H_{19}NO_3$; it is insoluble in water, sparingly so in ether, but soluble in alcohol. It melts at $100^{\circ} C.$ ($212^{\circ} Fahr.$). The solution has the pungent hot taste characteristic of pepper. It is a weak base, but it forms salts with some acids, and with chlorides of platinum and mercury. When boiled with caustic potash it is split up into piperic acid ($C_{12}H_{10}O_4$) and piperidine ($C_5H_{11}N$).



Piperic acid crystallizes in yellow needles, melting at $150^{\circ} C.$ ($302^{\circ} Fahr.$), and subliming at $200^{\circ} C.$ ($392^{\circ} Fahr.$) It is insoluble in water, and nearly so in ether, but is soluble in boiling alcohol and in benzene. It forms a number of crystalline salts called piperates, and having the general formula $C_{12}H_{10}O_4$.

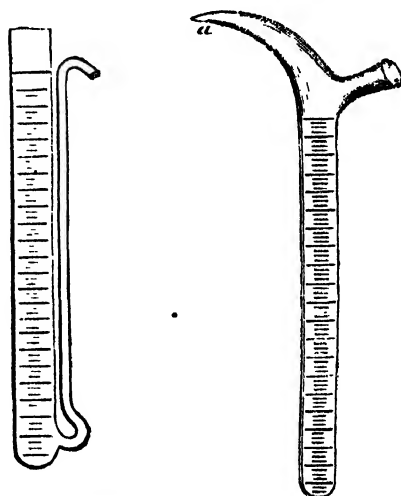
Piperidine is a colourless basic liquid with ammoniacal odour. It boils at $106^{\circ} C.$ ($223^{\circ} Fahr.$) It is very soluble in water and in alcohol. It forms with acids a number of crystalline salts, and crystalline compounds with chlorides of gold and platinum. It also forms with piperic acid, piperate of piperidine ($C_5H_{11}N, C_{12}H_{10}O_4$).

PIPES, VIBRATION IN. See ORGANS-PIPES.

PIPETTE, a tube for delivering drops of any liquid. Usually it has a bulb in the middle, and the delivery orifice

Fig. 1.

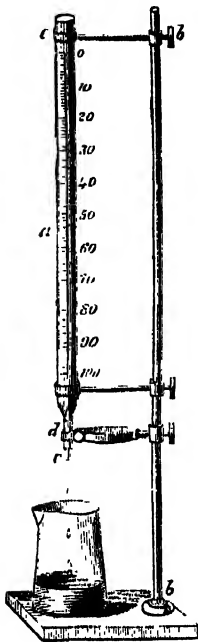
Fig. 2.



is drawn out almost to a point. If the test-fluid be sucked up into the bulb, it will not flow if the upper end

be closed by the finger, but will flow when air is admitted above: suitable regulation will deliver even single drops.

Fig. 3.



A graduated modification of the simple pipette is called a *burette*: and is used for gradually supplying small additional quantities of reagents in chemical testings. There are several kinds. Fig. 1 represents Gay-Lussac's burette. Bink's burette, fig. 2, is much less fragile; the solutions are, however, liable to run down outside the spout, *a*. This can be prevented by applying a little stiff lallow to the spout, and boring through it a small hole with a needle. To manage this instrument properly it must be held near the top, the thumb being placed above the scale. If it be held lower down the delivery of single drops is difficult. The most convenient of all forms of burette is that of Mohr, fig. 3; *a* is a cylindrical tube which is graduated into 100 parts, 0° being at the top and 100° at the bottom. The tube is open at both ends, but the lower end is contracted, and is connected by a short flexible tube of vulcanized caoutchouc with a small glass jet, *c*. Across the flexible tube is placed a pinch-cock, *d*, which closes the tube when it is left at rest, and opens it when the buttons at *d* are slightly pressed with the finger and thumb.

It is easy either to let out a continuous stream of the test liquor, or to limit its passage to single drops. The burette is suspended by a ring of cork or caoutchouc from the upper arm, *c* *b*, of the support. The lower arm serves to keep the burette in a vertical position. The point, *c*, is fixed at such a height above the table as to allow free access to the vessel containing the liquid to be tested.

PIPIN. See PIPPIN.

PIPING CROW (*Gymnorhina tibicen*) is a species of passerine birds belonging to the Crow family (Corvidæ). It is a large species, measuring 16 inches in length. The greater part of the plumage is deep black, but the nape of the neck, the wing and tail coverts, and the rump are white. The piping crow is an inhabitant of New South Wales, making a large cup-shaped nest in trees of sticks, leaves, and wool. It feeds chiefly on insects, which it captures on the ground, devouring immense numbers of locusts and grasshoppers, and in captivity takes almost any kind of animal food. Its loud piping note is rich and mellow. In captivity it learns to imitate the voices of other animals, and can be taught to whistle tunes with great accuracy. Another species, *Gymnorhina organica*, the organ bird of the Tasmanian colonists, is an equally amusing pet from its powers of mimicry. According to Gould, in the early morning this bird perches upon the dead branch of a gum-tree, and pours forth a succession of notes resembling nothing so much as the sounds of a hand-organ out of tune.

PIPET (*Anthus*) is a genus of Passerine birds resembling in appearance and habits the larks, but now classed in the family Motacillidæ together with the wagtails. The best known species, the Meadow Pipit or Titlark (*Anthus pratensis*), is a permanent resident in Britain, and occurs all over the continent of Europe, in Northern Africa, and in Asia. It measures about 6 inches in length, is of a brown

colour above and whitish beneath, with the breast spotted with dark brown. Commons and waste lands are the favourite resort of this bird, where it seeks its food, consisting of insects, worms, and slugs, upon the ground, running along with great facility, and occasionally vibrating its tail in the manner of the wagtails. The nest is built upon the ground among herbage, and usually contains from four to six eggs; it is one of the favourite nests with the cuckoo for receiving her eggs. The song of the male is soft and musical, but short; it is usually uttered whilst hovering over the nest.

The Tree Pipit (*Anthus arboreus*) is a summer visitor to Britain, and is most common in the wooded parts of the southern counties. It is a rather larger species, perching in trees. Its song is loud, resembling that of a canary. A third species, the Rock Pipit or Rock Lark (*Anthus petrosus*), is a permanent resident in our island, and haunts almost every part of the sea-coast. It feeds on small crustaceans, &c., running about on the beach among the seaweed left by the retiring tide. The nest is placed on the ground or on the ledge of a rock. The American Titlark (*Anthus ludovicianus*), a winter visitor to the United States, resembles the meadow pipit in size and appearance. It breeds far north. Several other species of pipits are known from India and South Africa.

PIPPL See ROMANO, GIULIO.

PIPPIN, first King of the Franks of the Karling (Carlovingian) dynasty, was the son of the great Karl or Charles Martel, victor of the Saracens. He inherited his father's ambition and courage, though not his personal prestige, being short and not well-made (*Pépin le Bref* is his French name), but to make up for this he excelled Karl in astuteness. Karl Martel had acquired the actual sovereignty of France, with the title of *maire du palais*, borne by his father before him (Pippin of Herstal), and at his death (741) he left this title jointly to his three sons Pippin, Carloman, and Griffo. When the Merwing Theodoric (Thierry) IV. died in 737, Karl Martel had named no successor, but he dared not take the title of king. Pippin and Carloman managed to get rid of Griffo, who fled to the Duke of Aquitaine, and they divided the realm between them. To cover their authority they dragged forth from the cloister a son of Chilperic II., a previous Merwing (Merovingian) king, whom they crowned as Chilperic III. Carloman soon tired of the world and entered a monastery, and Pippin found himself sole master of France. He reigned for some years as *maire du palais*, but eventually applied to Pope Zacharius, who in 752 decreed his right to the title of King of the Franks, giving the very sensible reason that it was not fitting for one man to wield the supreme power and another to have the supreme title. The poor half-witted Merwing king, Chilperic, was sent back with all kindness to his monastery, and there died in obscurity. Pippin was consecrated by St. Boniface, the apostle of Germany, and then, calling a general assembly of the Franks at Soissons, he was formally elected king.

The new Pope, Stephen III., now demanded the price of his predecessor's decree. The Popes had been struggling with Astolphus, king of the Lombards, for the sovereignty of Rome, and Pippin had promised help. This he now loyally gave (755), entering Italy and driving Astolphus from Rome. But as soon as he had crossed the Alps, the Lombard returned and besieged Rome, whereupon Pippin returned swiftly and drove out the Lombards from the entire territory of the Exarchate of Ravenna, which he presented to the grateful Pope as a temporal possession (756), thus founding the PAPAL STATES. [See also the article DONATION.] Pippin was crowned a second time at Rome, reviving the Jewish ceremony of anointing for the greater solemnity of the act. The Pope also appointed him Patrician, or Viceroy,

of Rome; thus in his turn paving the way for the Frankish or Holy Roman Empire.

Pippin now turned his victorious arms against the Bretons on the one side of his kingdom, and the Saxons on the other, and having made himself respected by them and thoroughly broken their power, he was free to attack the Saracens, who still held Septimania, the country lying along the Mediterranean between the Pyrenees and Provence, of which *Narbo*, the modern Narbonne, was the capital. This province he conquered and annexed to his dominions (758). Aquitaine still lay between him and the Bay of Biscay: and Aquitaine, ruled over by Merwing princes who had adopted the Latin language and Roman civilization of their people, was at that time a far more polished state than Gaul, especially now that the Karling king had filled it with half-savage Teutonic warriors. Family and race hatred combined to make the war as fierce as possible. Hunald, duke of Aquitaine, had acknowledged his vassalage to France in 745, but soon abdicated in favour of his son Guinifer, whom he charged with the duty of revolt, he himself retiring into a monastery. Guinifer did little for some years, gathering his strength meanwhile, and he was therefore in 759 ready to meet the hated foe and answer ravage by ravage. Pippin laid waste Berry, Auvergne, and Limousin, and at last Guinifer, driven to desperation himself, destroyed the fortifications of all the towns left to him, and continued a ferocious guerilla warfare from the hills. His own people, tired out by the useless strife, assassinated him in 762, and submitted to Pippin.

The conquest of Aquitaine was the Frank monarch's last great exploit. He died in 768 and left his kingdom to his sons Karl (or Charles) and Carloman. See CHARLES THE GREAT.

PIPPIN (Fr. *pipin*, pip, kernel) is the name of some fine varieties of apple, as the Golden Pippin, Ribston Pippin, &c., which are especially esteemed for the table. Pippins seem to have been little known in England till the latter half of the sixteenth century. They were so called because the trees were raised from the pips or seeds, and bore the apples without grafting. Shakespeare makes general references to pippins as an esteemed dessert fruit.

PIRACY, PIRATE, immediately from the Latin *pirata*, and remotely from the Greek *peiratēs*, which had the same signification as our word pirate.

The offence of piracy by the common law of England consists in committing those acts of robbery and depredation upon the high seas, which, if committed upon land, would have amounted to felony there (4 Blacks., 72).

By statute some other offences are made piracy, as by statute 11 & 12 Will. III. c. 7. The dealing in slaves on the high seas is piracy, and subjects a person to transportation for life or not less than fifteen years, or to be imprisoned for not exceeding three years (5 Geo. IV. c. 113; 1 Viet. c. 91).

Persons guilty of piracy were formerly tried before the judge of the Admiralty Court, but the statute 28 Henry VIII. c. 15 enacted that the trial should be before commissioners of oyer and terminer, and that the course of the proceedings should be according to the law of the land. Further provision was made with respect to the trial of offences on the high seas by the statutes 39 Geo. III. c. 15; 43 Geo. III. c. 113; 46 Geo. III. c. 54; and now the trial of offences committed on the high seas is, by the 24 & 25 Viet. c. 100, s. 68, in the place on land where the offender is apprehended, in the same way as if the offence had been committed on land. Piracy is in some cases punished with death, in others by penal servitude.

In Scotland piracy and all crimes perpetrated on sea were formerly tried in the Court of Admiralty, but are now tried in the Court of Justiciary.

PIRÆUS, a town of Greece, the port of Athens, and 5 miles south-west of that city. The modern town—which has been built since 1834—is also called *Porto Leone*, and is on a hilly peninsula containing the remains of the tomb of Themistokles. It has a custom-house, quay, and lazaretto; and 21,000 inhabitants. There are some good houses and shops; and a macadamized carriage road, shaded by groves of olives, as well as a railway, connect it with Athens. The entrance to the harbour is narrow, but inside it is both safe and deep. Vessels representing over 1,500,000 tons enter annually. The ancient town is described under **PEIRÆUS**.

PIRANE'SI, GIOVANNI BATTISTA, the great Italian engraver, was born at Venice in 1720, and was sent by his father (who was a mason) to study architecture at Rome. He refused to return; and being thrown upon his own resources, the young artist soon after (1741) brought out his first work on triumphal arches, bridges, and other architectural remains of antiquity. This production instantly established his reputation, the engravings being treated with such mastery, and being altogether so decidedly superior to any former representations of similar subjects, as to make an epoch in chalcography and architectural delineation.

The following is a list of his principal works:—"Architectura Romana," 208 plates, four vols., atlas folio; "Fasti Consulares Triumphalesque Romanorum;" "Antichità d'Albano," 35 plates; "Campus Martius," &c., 54 plates; "Magnificenza dei Romani," 44 plates; "Vedute di Roma," two vols., 130 plates of modern buildings at Rome; "Collection of Candelabra, Vases," &c.; "Collection of Chimney-Pieces," a series of most splendid designs; "Carceri d'Invenzione," 16 plates, filled with exceedingly wild but most picturesque conceptions; "A Collection of Ancient Statues and Busts," 350 subjects; "The Trajan and Antonine Columns;" "Antiquities of Herculaneum and Pompeii." A complete set of his works (comprising many not here enumerated) amounts to no fewer than twenty-nine folio volumes.

Piranesi did not execute much as a practical architect; but what he did so satisfied Clement XIII. that he created him a "cavaliere." He died at Rome, 9th November, 1778.

PIRITHOOS, PISIS/TRATOS. See **PEIRITHOOS, PEISISTRATOS**.

PIR'NA, a town in Saxony, situated on the left bank of the Elbe, 12 miles by railway south-east from Dresden, has 11,670 inhabitants. Most of the houses are built of stone from the celebrated quarries near the town. The principal public buildings are—the town-hall, the Gothic cathedral, the convent church, the Church of St. Kunigunda, and the orphan asylum. On a high rock near the town, called the Sonnenstein, there is a strong fortress, now used as a lunatic asylum. There are manufactures of cotton, linen, woollen cloth, earthenware, tobacco, leather, ironmongery, starch, &c. Calico-printing is carried on. Hops are largely grown in the neighbourhood. Frederick the Great of Prussia obtained a signal victory over the Saxons at Pirna in 1756. A few miles north of this town, and 5 miles from Dresden, on the right bank of the Elbe, is the fine palace of Pillnitz, the summer residence of the royal family of Saxony, where, on the 25th August, 1791, the convention of the European powers to maintain the rights of the Bourbons to the throne of France was concluded.

PIR'ON, ALEXIS, born at Dijon in 1689, studied the law, took his degrees, and practised as an advocate in his native town; but he afterwards forsook the bar, and lived for a time in gay and dissipated society. Being distressed in his circumstances, he repaired to Paris and employed himself as a copyist, and afterwards produced the finest epigrams in French literature, and one capital comedy "*La Métromanie*." No one except Catullus has

even come up to Piron in the art of packing in a few light and graceful lines the greatest possible quantity of malicious wit. The amount of his work, judged by quantity, is very little. He died in 1778.

PISA, one of the principal cities of Central Italy, is situated in a fertile plain, through which flows the Arno, 45 miles west from Florence, 13 miles north by east from Leghorn, and about 4 miles from the sea-coast. The town is divided by the river into two nearly equal parts, connected by four bridges, one of which is built of marble. The circumference of the walls is about 6 miles, the quays along the Arno and several other streets are wide, well paved, and lined with handsome buildings. The population, which once exceeded 100,000, is now 53,924. The four remarkable buildings of Pisa—the Cathedral, Baptistery, Campanile, and Campo Santo—are grouped near one another in a vast open place at the western extremity of the town, and are all marble edifices. The Duomo, or cathedral, begun in the eleventh century, is a splendid Gothic structure, the type and highest excellence of the Lombardic style, cased externally with marble of various colours, and ornamented with numerous rilievs, inscriptions, and columns of various sizes put together with exquisite taste; the elliptically shaped dome, pulpit, and pictures are all worthy of admiration. Since 1864 this building has been carefully restored. An engraving of it is given in the Plate illustrating the article **LOMBARDIC ARCHITECTURE**. The Baptistery, detached from the church, is round, 160 feet in diameter, famed for its wonderful echo, and ornamented with numerous sculptures; the pulpit in particular is considered one of the world's wonders. It is a masterpiece of Niccolò Pisano. The famous Campanile, or "leaning tower," is a round tower, built in the twelfth century, 188 feet high, and 53 feet at the base, which deviates from the perpendicular line about 14 feet. It is now understood that this deviation arose from an imperfect foundation, and was known and provided for by the architect when the structure was half completed. An engraving of it is given in the Frontispiece to Vol. III. The Campo Santo, or cemetery, constructed by Giovanni Pisano in the thirteenth century, is a long parallelogram, 430 feet in length, with an arcade or cloister running all round the interior, the walls of which are covered with fresco paintings, chiefly by Giotto, by some Dominican artist, wrongly said to be Orcagna, by Spinello Aretino, and by Memmi. The paintings are for the most part greatly damaged, and some are entirely obliterated. Several priceless ancient sculptures and other remains of antiquity are deposited in the Campo Santo; the latter including some earth brought from the Holy Land in the twelfth century, and formerly used for a mausoleum.

The other remarkable buildings of Pisa are—the churches of San Stefano, with one of the largest organs in Italy; San Frediano, rich in paintings; San Nicola, with a handsome belfry; San Michele in Borgo; and Santa Maria della Spina, with good paintings and sculptures. Other buildings are the palace of the Academy of the Fine Arts; the palaces of Lanfranchi and Lanfreducci; the Torre della Fame, in which Ugolino and his children were starved to death, which formerly stood on the site of the present Palazzo dell' Orologio; the great hospital; the Loggia, or old Exchange, the city-hall, custom-house, prisons, hospitals, theatre, &c. The University of Pisa was for many years the chief means of maintaining some life in the town. It is divided into three faculties—theology, law, and medicine; it reckons among its professors several distinguished men, and is still the great centre of education in Tuscany. Belonging to it are—a library of 60,000 volumes, an observatory, museums of natural history, and a botanic garden. Pisa also contains a college of nobles, an episcopal seminary, and many other public schools. Galileo was born in this city. Near Pisa are the Certosa, or Carthusian

convent and church; the vast farm and forest of the late grand-duke at San Rossora; and the mineral baths of San Giuliano.

About $8\frac{1}{2}$ miles to the north are the Bagni di Pisa, medicinal baths, which are frequented in summer by many visitors. The city is connected with Genoa, Florence, and Leghorn by railways, and is supplied with water from Ascanio by an aqueduct 4 miles in length. The old citadel is now used as a house of correction.

Pisa is the seat of an archbishopric, and of the civil government of the modern province of the same name in the kingdom of Italy, which includes an area of 1131 square miles, and in 1882 contained a population of 283,210.

History.—The city of Pisa was founded about six centuries before Christ, and like the other Etruscan cities, in due time fell under the dominion of Rome. It preserved, however, its own municipal privileges. From the Roman emperors it received many favours, but on the decline of the Roman power was unable to defend itself against the various invasions of the Northmen. Afterwards it grew into a powerful republic, which yielded little more than a nominal homage to the German emperors, the successors of the Cæsars. It extended its territory in every direction, and in 1137 subdued the flourishing town of Anagni. It played a prominent part in the great wars which distracted Italy during the eleventh and twelfth centuries, and assisted the first and third crusades with a well-equipped fleet. Its sailors shared the commerce of the Mediterranean with those of Genoa. Its fleet subdued the Saracens, and its armies fought for the emperor in Northern France. Its commerce was extensive, and the wealth of its citizens enabled them to adorn its streets with buildings of the finest architecture. Sardinia, Corsica, and the Balearic Islands owned its supremacy; but taking part with the Ghibellines in their protracted struggle against the Guelphs, the Pisans excited the jealousy and hatred of Florence, and, unable to maintain their independence against internal and external foes, placed themselves under the protection of Galeazzo Visconti, lord of Milan. The son of the latter treacherously sold Pisa to its ancient enemy, Florence, from whose sway it was temporarily relieved by Charles VIII. of France, in 1494, at the urgent prayer of its inhabitants. The French, however, were eventually expelled from Italy, when a bitter struggle arose between Florence and Pisa, and the latter was finally overcome in 1509. Many of the leading families then emigrated to Sardinia and Sicily. It is now rapidly increasing in population and wealth. The rival popes, Benedict XIV. and Gregory XII., were deposed at a council held at Pisa in 1409, and Alexander V. elected in their stead.

PISANI, THE, a distinguished group of artists of the thirteenth and fourteenth centuries—painters, sculptors, and architects—so called from the place of their birth, Pisa: Giunta, Niccolò, Giovanni, and Andrea Pisano.

GIUNTA PISANO, or **GIUNTA DI GIUSTINO** of Pisa, is the earliest known Tuscan painter, and he is said to have been instructed by some Greeks engaged at Pisa at the close of the twelfth century. A crucifixion painted by him for the Church of Santa Maria degli Angeli there, about 1236, is still preserved, is of good impasto, and has some excellent qualities of art for its period. It is inscribed "Junta Pisanus Justinus me fecit." This work shows Giunta to have been a superior master to Cimabue in taste or form at least, though he preceded him by a generation.

NICCOLÒ PISANO, born about 1205, was equally distinguished as a sculptor and architect. He was the contemporary of Giunta, and was established as early as 1225. He earned a great reputation by his tomb or arca of San Domenico, executed at Bologna, conspicuous for its excellent bas-reliefs. As an architect he built the church

and convent of San Domenico at Bologna; the Church of Sant' Antonio at Padua; and the celebrated Church of the Frari at Venice, distinguished for the then novel classical character of its ornamentation. He built also the Church of the Santa Trinità at Florence, besides many other excellent churches in various cities of Italy, including the Campanile of San Niccolò at Pisa. In 1260 he executed a pulpit for the Baptistery of Pisa, and after the completion of this in 1266, a similar but richer work for the Cathedral of Siena. In 1274 he began the glorious fountain at Perugia, finished by his son. Niccolò died at Pisa in 1278. Among the pupils of Niccolò was the famous Arnolfo di Cambio, architect of the Florentine cathedral, and author of the beautiful altar canopy at San Paolo fuori le Muri at Rome. In some of his later works Niccolò was assisted by his equally distinguished son Giovanni.

GIOVANNI PISANO was born about 1240, died in 1320, and was placed in the same tomb with his father in the Campo Santa at Pisa, one of his own architectural monuments, finished in 1283. Among his principal works are, in architecture, the Castelnuovo at Naples; in sculpture, the fine Madonna del Fiore at Florence, an altar for the cathedral at Arezzo, pulpits for the Church of Sant' Andrea at Pistoia, and for San Domenico at Perugia, and the sculptures of the "Last Judgment" on the front of the Cathedral of Orvieto—the most remarkable works of their time. Giovanni Pisano was architect for ten years of the wonderful cathedral at Siena, and may have helped to design that lovely façade which is the rival to the glories of Orvieto. A magnificent pulpit with many statues of life size, made by him for Pisa, was taken to pieces in the middle ages and quite lost. Recently one figure after another, and one panel after another, have been discovered, and models of the entire pulpit have been made. A careful copy of the whole as restored is at the South Kensington Museum. It fully justifies the great reputation of this famous pulpit among the contemporaries of the artist. It occupied Giovanni from 1302 to 1311.

ANDREA PISANO (not a relation of the two previous artists, but simply a pupil of Giovanni) was born in 1280. He was also an architect, but was most distinguished as a sculptor, and was the most celebrated metal founder of his age. He executed the first (and, from the point of view of design, the finest) pair of bronze gates for the celebrated Baptistery of Florence, containing a series of reliefs from the life of John the Baptist. From the inscription they bear, they were apparently completed or cast in 1330. Andrea was made a citizen of Florence, and died there in 1345. He was buried in Santa Maria del Fiore, the cathedral of Florence.

PISANO, VITTORE, of Verona, called also *Pisanello*, was at once the founder of the revived art of making portrait medals, and its greatest master. His works are larger in size than the coins of antiquity and the Roman medallions, and they are cast, not struck, in fine bronze. Inferior to the purest Greek specimens of money in absolute beauty, these Italian Renaissance medals, and especially those of Pisano, have a dignity of portraiture and a felicity of composition that bring them into not unworthy rivalry with the Greek, and carry them far beyond the Roman work. Portraiture is idealized in them; we see the character of the man depicted in his lineaments and his attitude—the moral qualities show clearly through the physical shell, and show, moreover, at their best. Pisano's greatest period was the decade from 1439 to 1449. His largeness and freedom of style could not express itself in the rigid methods of die-engraving; he was a painter originally, a medallist only in the second place (although his fame reposes entirely upon his splendid achievements in the new art): and he needed a broad space and a yielding material wherein to work out his conceptions. This he found in a slab of wax, which he moulded from

the life, just as the sculptor moulds in clay. Then a hollow mould or matrix was prepared from the original relief, by an elaborate and careful process, and from this matrix the copies were cast. About thirty medals of Pisano's are known, perhaps the finest being the portrait of Sigismondo di Malatesta, a truly wonderful work. Pisano was a painter of high merit, but his supreme excellence as a medallist has cast his paintings into somewhat undeserved neglect.

PISCES (the Fishes), the last constellation of the old zodiac. There is in the mythological stories (which are unworthy of note) a confusion between this constellation and *PISCIS AUSTRALIS*, presently to be noticed. The constellation consists of two fishes linked by a string attached to their tails: they are not close together, the upper one being close to Andromeda, the lower one under the wing of Pegasus. (See *PLATE CONSTELLATIONS* Northern Hemisphere, by the figure xxiv.) The sun enters the sign of Pisces about the 19th February, and leaves it about the 21st March; but the constellation occupies the zodiacal region corresponding not to its own sign, but to the sign of Aries. The well-known binary star Alpha Piscium is the most interesting object in the constellation, which is peculiarly rich in double stars.

PISCICULTURE is the art of breeding, rearing, and cultivating fish. This art has existed from a very remote antiquity. It was originally practised by the Chinese on a very extensive scale, and with them became a source of wealth, tending to the increase of the supply of food. It would appear from a passage in the Old Testament (Isa. xix. 10) that fish-ponds were in vogue in Egypt. It is certain that they were greatly favoured by the Romans. Every opulent citizen boasted of his ponds, and was wont to spend large sums of money upon them. Those of Lucullus, the celebrated epicure, are said to have cost a sum equal to £30,000. In the middle ages pisciculture found patrons in the monks, to whom it was necessary as a provision for their fast days. It was thence brought down to our own time by Jacobi, who in 1748 carried out successful experiments in breeding salmon and trout. The art is now practised in many countries of Europe, particularly in Germany and Sweden, and of late years in France. The use of fish-ponds was really revived in this country by Mr. Shaw of Drumlanrig in 1837. In the investigation of the problem—Was the small fish found in salmon rivers, and known by the name of the parr, a young salmon, or otherwise? Mr. Shaw commenced a series of experiments, in the course of which he succeeded in artificially fertilizing the eggs of the salmon and rearing the young fish. In France the practice of pisciculture was revived by Gehin and Remy, two poor fishermen of Brest, in 1842. Their labours led to the establishment of the public piscicultural institution at Huningue, near Strasbourg.

The object of pisciculture is to counteract the destructive effects of fishery; and both terms are usually held to apply not only to fish in the scientific sense, but to all the inhabitants of fresh and marine waters which are useful to man for food and for other purposes. To prevent useful fisheries being destroyed by over-fishing it has in this, as in other countries, been in many cases found necessary to protect them by various legislative measures. In the case of fresh-water fishes it is easy to see that, unless restriction is placed by law on the liberty of capture all the year round, the species may become practically exterminated and the fishery destroyed. But in marine fisheries, such as that of the herring and the oyster, the establishment of a "close time" does not seem to be of much effect, though the law may usefully prohibit the capture of individuals below a certain size.

Of late years the preservation of the food-supplies of sea and river has received a great impetus from the exten-

sion of the system of artificial fertilization. The ova of the female are pressed out into a shallow receptacle, and the milt of the male squeezed out over them. The fertilized eggs are carefully tended till hatched, and the young fish also require great management for some time. In this way not only fish proper, but also oysters are artificially reared with great success.

"Fish Culture," by Dr. Francis Day, one of the handbooks of the International Fishery Exhibition, London, 1883, is one of the best treatises on this subject.

PISCINA, a niche on the south side of the altar in Roman Catholic churches, containing a small basin and water-drain, through which the priest emptied the water in which he had washed his hands and rinsed the chalice at the celebration of mass. In many of the old English churches the niche has been preserved. Sometimes it is double, and usually it is enriched with characteristic ornaments. It is placed on the south side of the choir.

The *piscina* of classical times was the fish-pond, without which no wealthy villa could be considered complete. Here the rarest table-fish were fed and fattened until the moment of their being required for the banquet. Afterwards the word came to mean a singular large uncovered tank in the open air, but used not as a fish-pond but as a swimming-bath—differing from the *natatorium*, which was

under cover, and the *baptisterium*, which was a cold plunge bath, both the latter being usual parts of the great public baths.

It is easy to see how in mediæval times the name came to be given to the baptisteries of churches, as it sometimes is; but it is not so clear how it came to be applied to the credence-table, or place whereon the holy elements were set previous to being placed on the altar. It is to be assumed that the frequent likeness of the form of the latter to that of a font is the explanation of the matter.

PIS'CIS AUSTRALIS or **NO'TIUS** (the Southern Fish), one of the old constellations of Ptolemy, situated directly under Aquarius. The stream from the water-pot of the latter constellation finishes at the mouth of this fish. [See Plate CONSTELLATIONS, Southern Hemisphere, xxii.] It contains a remarkable star of the first magnitude, Fomalhaut, which only just rises above the horizon in these latitudes; when on the meridian, it is nearly in the same vertical line with α and β Pegasi.

PIS'CIS VO'LANS (the Flying-fish), one of Bayer's southern constellations, situated between the South Pole and Argo. See Plate CONSTELLATIONS, Southern Hemisphere.

PIS'OLITE (pea-stone). See OOLITE.

PISTA'CIA is a genus of dicotyledonous plants be-



Pistacia vera.

longing to the order ANACARDIACEÆ. The species of this genus are small trees dispersed throughout the temperate zone of the Old World, being found in South Europe, North Africa, and extending throughout Western Asia to China.

A single species is found in Mexico. The flowers are dioecious and apetalous; the male flowers have five stamens inclosed in a small five-parted calyx; the female are three or four-parted, with a one-celled ovary. The fruit is a

dry drupe, with a horny, one-seeded stone. *Pistacia terebinthur*, the turpentine tree of Southern Europe, Asia, and North Africa, grows to about 35 feet in height. Incisions are made in its bark at certain seasons, and from these issues the well-known resin of commerce, Chian turpentine, reckoned the best kind of TURPENTINE. The tree is much grown in the island of Chio, whence the name of the resinous exudation. Galls are also often found in its leaves, and from them a silk dye is obtained, which used to be much sought after in the Levant; they are also used for tanning morocco leather. *Pistacia lentiscus*, the mastic tree, a native of Southern Europe, Asia, and Africa, produces the resin known as MASTIC. It is a small tree, about 15 or 20 feet high. *Pistacia vera*, the tree which produces the Pistachio nuts, is a native of Syria, but has been introduced into the South of Europe and Tunis, and naturalized in some parts. It is 20 or 30 feet high, with leaves composed of three or five ovate leaflets. The fruit is nearly an inch long, and contains a seed, the PISTACHIO NUT, with bright green cotyledons. The tree is hardy in England, flowering and even fruiting, but the heat of our summer is not sufficiently great to ripen the fruit.

PISTACHIO NUT is the seed of a small tree, *Pistacia vera*. This tree is a native of Syria, but is cultivated in parts of the South of Europe and in Tunis for the sake of its edible seeds. The nut is oval, about an inch long, and splits into two valves when ripe. The kernel is bright green, with a delicate flavour, much resembling sweet almonds. The Turks and Greeks are exceedingly fond of these nuts. They contain much oil, which may be expressed for culinary and other purposes; in consequence they soon become rancid, and are but little exported. They are eaten either dried like almonds, or made into articles of confectionery. See PISTACIA.

PISTIL, in botany, is the female part of the flower in the common flowering plants. The pistil occupies the centre of the flower, and like the stamens, petals, and sepals, consists of modified leaves, which in this case are called carpels. The carpel represents a leaf with infolded margins, upon which are borne the ovules; the inner cavity thus formed is the OVARY. The upper part of the carpel is frequently drawn out into a slender stalk, the style, which ends in a glandular surface, the stigma. The stigma, which is often sessile on the ovary, is fitted for the reception of the pollen grains, which, putting out their tubes, make their way through the tissue of the style, and so fertilize the ovule, which then becomes a seed. Two kinds of pistils are distinguished—*syncarpous*, in which a number of carpels are more or less united together; and *apocarpous*, in which there is a single carpel, or, if more are present, they are distinct from one another. In monstrous flowers (e.g. the double cherry), green leaves are sometimes developed in the centre instead of pistils.

PISTOIA or **PISTOJA**, the ancient *Pistorium*, a town of Central Italy, on the railway from Florence to Pisa, in the province of, and 20 miles north-west from the city of Florence, in a plain at the foot of the Apennines, and near the Stella, a tributary of the Ombrone, which is an affluent of the Arno. Pistoia lies on the highroad leading from Florence to Modena over the Apennines. It is a well-built town of considerable size, and has 51,552 inhabitants. It gives title to a bishopric, is inclosed by ramparts and bastions, and defended by a citadel.

There are many remarkable buildings in Pistoia. The cathedral, which was built by the Countess Matilda in the early part of the twelfth century, and restored by Niccolò di Pisa, contains some good paintings, bassorilievos, and monuments. The other churches worthy of notice are San Pietro Maggiore, L'Annunziata, San Filippo Neri, Santa Maria dell'Umiltà, San Giovanni Battista, San Domenico, and San Giovanni Rotondo. The Palazzo del Comune, or degli Anziani, dates from the

thirteenth century, and contains several monuments of the middle ages. The episcopal palace and the clerical seminary, both built in the last century by Bishop Ricci, are handsome buildings. The town also contains two public libraries, an academy of sciences and belles-lettres, a museum of natural history, and a theatre. The chief manufactures are—woollen cloth, silk, leather, iron wares, cutlery, and gun barrels. The pistol is said to derive its name from this city, where it is believed to have been invented and first manufactured. Pistoia was the birth-place of Pope Clement IX.

PISTOL (Italian *pistola*, the name of the town, now *Pistoja*, where pistols were first made, in Tuscany), a short fire-arm with a curved stock, intended to be used by one hand only. In the English army a weapon of this kind was introduced as early as the reign of Henry VIII., but for many years its clumsiness and weight rendered it of little use. Improvements, however, were gradually introduced into its construction, and pistols now vary in size and weight from the little "pocket Deringer," weighing about 7½ oz., to the large and powerful army revolvers.

Revolvers were employed as early as the seventeenth century, the first idea being to have several revolving barrels, but this plan was soon abandoned for a revolving breech cylinder containing several chambers, each of which contained a charge, and was fired in rotation as it came into position opposite the barrel. In our Plate, fig. 1, we represent a highly finished flint-lock revolver, which was constructed as early as 1640.

Pistols underwent the same successive modifications as guns in regard to the manner of loading and of igniting the charge, modern weapons of the best class being now almost invariably breechloading central fire revolvers. For the perfection of the present weapon we are greatly indebted to the genius of Colonel Samuel Colt of the U.S. army, who in 1838 patented his famous revolvers. They were six-chambered, each chamber had a nipple for a percussion cap, and the cylinder revolved by the action of the trigger; it was their excellence and wide popularity which stimulated our gunmakers to further improvements. One of the greatest drawbacks to the use of the early models was the fact that the cylinder had to be taken out to be reloaded, and many ways have been contrived to obviate this; the latest are the "self-extracting" types, of which the Galand and Somerville was the first; in it the depression of a lever moved the barrel and chambers forward, on which the empty cartridges fell out; in Thomas' revolver the empty cases are extracted by turning over the barrel and drawing it forward; but perhaps the best of all is that given in our Plate (fig. 4). By pressing on two thumb-pieces the catch A is released, and the barrels may be bent down; when this is done the extractor, B, rises and ejects the empty cases, and then returns to its place to allow the insertion of the new cartridges.

In fig. 2 we represent Colt's "frontier" pistol, the one adopted by the U.S. government for their cavalry as the pistol best adapted to meet all the requirements of military service. It is a very powerful weapon, length 12½ inches, calibre .450. Fig. 3 is Colt's breechloading Deringer pistol; weight 7½ oz., length about 5 inches.

Compared with rifles pistols are uncertain in aim and deficient in range and power, but at close quarters they are a valuable help in time of need. At all times they are a most dangerous toy in the hands of young persons. See also SMALL ARMS.

PISTOLE, a gold coin of Spain. The name is, however, not Spanish but French, and was originally *pistolet*. It was given in joke to the "crown" of Spain, because it bore to the larger "crown" of France the relation of a pistol to a gun. The usual pistole of Spain was worth about 16s., the *doubleon* (double-pistole), worth four times as much (£8 4s. 8d.), being still found in Mexico, weigh-

ing 7-626 grammes. There is an Isabella doubloon still found in Spain, which has now no relation to the pistole, being worth 100 reals or 5 dollars; it weighs 8-3866 grammes, is 900 fine, and worth £1 0s. 7½d. Nearly all the other Spanish doubloons, of which there were several, have now disappeared. The pistole in use in the West Indies is worth £1 6s. 8d., and is probably an altered descendant of one of the varieties of the Spanish doubloons or double-pistoles.

PISTOLE is also the name of a gold coin circulating in Hanover, Brunswick, and Denmark, equal to 5 thalers (14s. 8d.), an attempt to approximate to the Spanish value—a relic of the Spanish rule over the Netherlandish countries. Another pistole is that till quite recently used in Hunburg, and still occasionally to be found in circulation, worth 10 marks 14 schillings—a little over 12s. Yet another was the Bremen pistole of 5 rixdollars (16s. 5d.)

PISTON. See **HYDRAULICS**.

PISTONS, CORNET A. See **CORNET-À-PISTON**.

PI'SUM. See **PEA**; **VICIF**.

PIT'A is the fibre of the leaves and roots of various species of **AGAVE**. This fibre is extremely tough, and is useful for making twine, rope, &c. The picture writing of the Mexicans is on paper made from pita fibre. The best known thread is known commercially as sisal hemp, and is the produce of *Agave rigida*, a species the cultivation of which is extensive in the United States. This fibre has been also employed in the manufacture of cloth.

PITCAIRN ISLAND, a small isolated island in the Pacific, the centre of which is in 25° 3' 37" S. lat. and 130° 8' 23" W. lon. It is about 7 miles in circumference, and very high, with precipitous sides, and almost without anchorage, the only landing-place being in Bounty Bay. Some of the rocks are volcanic. The highest point of the island is 2500 feet above the sea level. Fruits, vegetables, and fish are very plentiful; and though there was no indigenous quadruped, goats, pigs, poultry, and other domestic animals have been imported, and thrive well. The surface is well wooded, the soil fertile, but porous; the supply of water rather deficient; and the climate very healthy, the thermometer ranging from 52° to 89° Fahr. The island was seen by Carteret in 1767; but it may be said to have been really first discovered by Captain Cook in 1777. In 1790 it was resorted to by the mutineers of the *Bounty* [see **BOUNTY**, **MUTINY** OR], consisting of nine British sailors and six male and twelve female Tahitian natives; but in consequence of discords and massacres, at the end of ten years there remained only one Englishman, Adams, the Tahitian women, and nineteen children, their offspring. Under the superintendence of this man the children were educated and trained up to habits of industry and morality. In 1825 Captain Beechy found a most interesting and intelligent colony of sixty-six persons. In 1831, with the sanction of the British government, all the inhabitants—a total of eighty-seven—were removed to Tahiti; but after remaining only five months there, at their own solicitation they were reinstated in their native land.

By the year 1856 it seemed as if the little population was increasing beyond the resources of Pitcairn, and the colony was removed, at the expense of the British government, to Norfolk Island; but in two parties, the first in 1859 and the second in 1864, they returned. They are recognized as a *bona-fide* colony of the queen's, and governed by one of their number who is annually elected as "magistrate and chief ruler in subordination to her Majesty the Queen of Great Britain." They were visited in 1878 by Admiral De Horsey, commander of the Pacific Squadron, who in describing them adopted, as being still strictly accurate, the language used respecting them fifty years before by Captain Beechy, viz.: "These excellent people appear to live together in perfect harmony and

contentment, to be virtuous, religious, cheerful, and hospitable; to be patterns of conjugal and parental affection, and to have very few vices." The chosen pastor fulfils also the duty of schoolmaster. English is the only language spoken or known, and good singing seems to be a leading feature in the social and religious exercises, most of the colonists having fine voices. All the daily wants of the community are supplied by their own industry, except clothes, for which they are to some extent dependent upon barter with passing ships. There are no springs, but rain falls, with sometimes doubtful regularity, once a month. No alcoholic liquors are used. There are no contagious diseases. Sculptured stone pillars and other remains, such as are found at **EASTER ISLAND**, prove that the island was inhabited in early times.

PITCH. See **TAR**.

PITCH, MINERAL. See **ASPHALT**.

PITCH, MUSICAL. A tone or degree in musical sounds, whether grave, or acute, or intermediate. The pitch of every note is produced by a certain number of vibrations, as explained in the article **ACOUSTICS**; and, moreover, any certain rate of periodic impulses, as drops of falling water, flickers of a gas jet, rattlings of a carriage wheel on granite paving, puffs of air, vibrations of a string or of a column of air, &c., will give the note corresponding in pitch to that rate of vibration per second; all these varying sources of sound yielding for the same rate of vibration precisely the same note, as regards its pitch; this note differing, however, in quality according to the nature of the vibrating body. Also, strings which can be set into vibration (as the strings of a violin, &c.) can, through alteration of their sounding lengths by "stopping," be made to produce a scale of sounds related to one another in terms of the length of the sounding string in the same manner, but harmonically, as the vibration numbers are related to each other geometrically. The string-fractions in fact exactly correspond as reciprocals with the vibration numbers. Thus if a string give out a certain note, half the string will give the Octave of the note, and twice the number of vibrations also gives the Octave. So also $\frac{2}{3}$ the string gives the Fifth above the whole string, whilst $\frac{3}{2}$ the number of vibrations gives the Fifth above any prime. The Fourth above the tone of the whole string is produced by $\frac{4}{5}$ its length, and $\frac{5}{4}$ the number of vibrations of any prime will give the note a Fourth above it. The string fractions $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{5}{6}$ for the Octave, Fourth, Fifth, major Third, and minor Third, answer to the ratios of vibration numbers $\frac{2}{1}$, $\frac{3}{1}$, $\frac{4}{1}$, $\frac{5}{1}$, $\frac{6}{1}$ for the same intervals.

If now we arrange these ratios we can produce a major scale. For the major common chord being made of a root, its major Third, and its Fifth, the ratios would be 1, $\frac{4}{3}$, $\frac{5}{3}$. And if we take 24 as our prime, the numbers will be 24, 30, 36, answering to **C E G** in the scale of **C**. Now take the similar chord **G B D** (starting from 36), and we have 36, 45, 54. Finally, the similar chord **F A C**, where **C** is twice 24 (or 48), gives us 32, 40, 48. Halving the 54 of **D**, so as to bring it within the Octave, and arranging alphabetically, we get the vibration formula for the major **SCALE**:—

C	D	E	F	G	A	B	C
24	27	30	32	36	40	45	48

That is to say, that if any given **C** has, for example, 11 times 24 vibrations (264) per second, the **D** next above it, if truly in tune, has just 11 times 27 vibrations (297) per second, and so on. It is therefore evident that if the pitch of one note, say **C**, is fixed, the pitch of the whole scale is fixed by relation to it.

The vibration-number just mentioned, 264, is the number of vibrations per second required to produce the "middle **c**" recommended by the Society of Arts; the French

diapason normal, set to the note a' , corresponds in just intonation to a c' of 261 vibrations, therefore a flatter pitch for the same note, or in equal temperament (the ordinary tuning) $258\frac{2}{3}$ would be the French c' ; and on the other hand, the Philharmonic Society and the opera-houses have until lately used a pitch considerably higher (270 as a rule). If the number 256 could be used, it would be very convenient, since this is a power of 2, and would therefore permit the whole of music to be determined by some hypothetical sound due to one vibration a second—far, far below the limit of human audition, since the ear cannot readily distinguish as a musical note even as few as 40 vibrations a second. This is what is called sometimes the “philosophical pitch.” Pitch is usually measured in England at c' , the Octave above middle c' ; and in all other countries at a' , the Sixth above middle c' .

The Society of Arts pitch was really $c'=528$, and the hypothetical “philosophical pitch” was $c'=512$: but all other pitches have been taken at a' , and c' , if required, must be calculated from this. Now herein lies a source of confusion. An absolutely perfect minor Third sung by a finished vocalist, or played upon the French horn, has the ratio 5:6, which would mean that an addition of a fifth of the number of vibrations at an a' pitch would give the note c' . But the necessities of the pianoforte, organ, flute, &c., in fact of all instruments with fixed tones, forbid the use of actually pure intervals under the penalty of music being limited to one key, and the minor Third of the equal temperament (now invariably in use) is smaller than the truth by $\frac{1}{11}$. Therefore to get the c' of “equal temperament” from any pitch given at a' we have first to find the just c' by adding $\frac{1}{11}$ th part to the vibration-number of the a' , and then to subtract $\frac{1}{11}$ th part from the result. The chief a' pitches in use in quite recent times are $a'=432$ of Italy (got by taking the “philosophical” c , which =128, as the lowest string of the viola, and then tuning the instrument by pure Fifths, giving an a' , the top string of the viola, of 432); $a'=435$, the *diapason normal* of France; $a'=440$, the pitch of Scheibler; $a'=452$, the pitch of Kneller Hall, i.e. of the British army; $a'=454$, Philharmonic and Crystal Palace orchestras; and $a'=455$, Albert Hall organ.

Taking all these pitches in order we have the following result, calculations of a' pitches being taken at both the equal and just minor Thirds.

VIBRATION-NUMBERS OF c' PITCHES ACTUALLY IN USE
IN ENGLAND IN 1886.

512 vib. per second	{ (“Philosophical pitch,” only theoretical.)
513.7	{ Italian ($a'=432$), by equal temperament.
517.8	{ Diapason Normal, French, fixed in 1859 ($a'=435$), by equal temperament.
518.4	{ Italian, by just intonation.
522	{ Diapason Normal, by just intonation.
523.25	{ Scheibler's pitch ($a'=440$), by equal temperament.
528	{ Society of Arts pitch, fixed in 1869, meant for Scheibler's, which it is, if taken at just intonation.
537.5	{ Kneller Hall pitch of British army bands, fixed in 1878 ($a'=452$), by equal temperament.
540	{ Philharmonic and Crystal Palace orchestras ($a'=454$), by equal temperament.
541	{ Albert Hall Organ ($a'=455.1$), by equal temperament.

The manifest inconvenience of so many pitches, resulting in the shameful fact that there was no standard pitch in England at all, and every one did what was right in his own eyes, induced many musicians to try and check the constant rise in pitch, and bring about some such settled order as that so happily attained in France by governmental authority in 1859 (*diapason normal*). The “Society of Arts pitch” was the outcome of such an attempt, made in the year 1869, but it unhappily added fuel to the fire. Meanwhile the pitch at the opera grew higher, so that artists accustomed to the French orchestras found themselves singing fully a quarter of a tone sharp in England. Conference after conference was held. The battle resolved itself at last into a contest between the orchestral and military bandmasters and instrument makers, and the organ builders, against the musical profession and the pianoforte makers. A very important series of meetings was held in 1885 on the occasion of the International Exhibition of that year (Inventions and Music), and especially on the receipt of news that Belgium had joined the French standard by governmental order. Several resolutions were passed as to the desirability of establishing some pitch which should be uniform in all Great Britain, and also in conformity with whatever might be most likely to meet with general acceptance in other countries, the object being to avert, if possible, the serious inconvenience to vocalists, instrumentalists, and manufacturers that had been consequent on the diversity which had prevailed in England for several years. A committee to carry these resolutions into effect was elected, consisting of eminent men of science, musicians, and musical instrument makers. The first step of this committee was to send a memorial to the commander-in-chief requesting that the bands of the British army might be required to have their instruments tuned to the proposed pitch, because, as the players on wind instruments in the orchestras of concert rooms and theatres are for the most part drawn from military bands, the pitch of their instruments, which is almost inflexible, necessarily regulates that of the others; and even singers are therefore controlled by it. But the War Office and Horse Guards returned a blank “non possumus,” founded chiefly on the score of expense; and the committee felt that there was nothing for it but to disband. Again in March, 1886, a determined attempt was made by a few members of the Common Council of London, to get the great Guildhall School of Music reorganized upon the French pitch, but the same question of cost of new wind instruments was then urged by the principal and conductor. Meanwhile Belgium, having already adopted the *diapason normal* in March, 1885 (Russia having accepted it some ten years previously), a congress was held at Vienna in November of the same year, attended by deputies of all the chief continental nations. At this important gathering Italy, which had clung to its $a'=432$ as being derivable from the “philosophical pitch,” at last gave way. It was found that in the military bands both of the Empire of Germany and of that of Austria it had become the fashion to play *exactly* half a tone sharp to the *diapason normal* (a fact tested with the band of the famous Pomeranian Hussars at the International Exhibition, August, 1885, by the present writer), and therefore the transposition was perfectly easy, and was agreed to by both empires. From November, 1885, therefore, all the continent of Europe has tuned by $a'=435$, the *diapason normal*.

History of Pitch.—This is indeed a most remarkable history. The honour of tracing it is entirely due to Mr. A. J. Ellis, who examined hundreds of tuning forks, pipes, organs, &c., and embodied the results in a detailed historical table ranging from the year 1361 to the present time, and published by the Society of Arts as the “History of Musical Pitch” in 1880. It is not too much to say of this investigation that it has placed England for the time at the

head of musical research. The results arrived at, which are not at all theoretical, but are actual measurements of existing data, and are all verifiable (Mr. Ellis giving the whereabouts of each fork, pipe, &c.), may be very briefly summarized as follows:—

The organ, as regards its church use, was originally a mere collection of pitch pipes, not intended for the accompaniment of voices in our modern sense so much as for giving out the proper reciting tone, and thus keeping the voices chanting throughout one chant at the same pitch. The pitch was varied according to well-known rules for various chants, and hence came the necessity for several pipes. (Later on the organ was used for purposes of disant, or true accompaniment, but that is a development leading away from the present subject.) It became necessary to fix the pitch of the organs, which was easy to be done by fixing the length of the pipes. Then came the question whether the *f* pipe or the *c* pipe should be used as a standard? The first would be a good medium note for basses, the second for tenors. Four feet was found to be a good length for a pipe, and the old treatises therefore recommend that length as a standard; but quaintly enough they advise that the four-foot pipe should stand for *f* or for *c*, according to the convenience of the moment. Thus the pitches of the dark ages varied by a whole Fourth! And this, moreover, is not taking any reckoning of the extraordinary variety of lengths which the foot had in various districts, provinces, and countries. At least a dozen "feet" could be readily given, ranging from 283 to 325 millimetres, so that a four-foot pipe in Saxony in these early times would sound a minor Third above the four-foot pipe of France, and a four-foot pipe in England would be at that date exactly midway between the two.

Meanwhile the private bands which played at the various courts of the princes found the extreme variations of the two church pitches inconvenient, and settled the matter by taking a mean between them. The *high church-pitch* was often $a' = 504$, and the *low church-pitch* $a' = 377$. The chamber pitch was therefore taken at $a' = 402$ to 407.

This confusion was sought to be obviated by the *mean pitch* of Praetorius, the distinguished musical theorist, which he recommended in 1619, and which was rapidly adopted all over Europe. This was $a' = 424$. It lasted for over two centuries. Handel's own fork is still preserved, and measures 422.5; Mozart's measures 421.6; the fork of the Philharmonic Society at its foundation measures 423.3. We have therefore the remarkable result that Bach, Handel, Haydn, Mozart, Beethoven, Weber, &c., all wrote to this pitch, fully half a tone below our military band pitch fixed in 1878, and a quarter of a tone below the French diapason normal fixed in 1859.

The standard A remained about $a' = 422$, and was essentially unaltered till the beginning of the present century; and in accordance with it the great classical masters, including Beethoven, selected the keys in which they thought their pieces of vocal and instrumental music would be heard to the greatest advantage. During the first half of the present century the pitch in general rose about half a tone, so that the note which Mozart and Beethoven wrote, and intended as a B flat, was actually played as a B natural. The real sufferers by this state of things were the singers; their vocal chords admit of no artificial screwing up. Beethoven's "Mass in D" became almost impossible of execution, and so with other great works, not only of the same composer (as the "Choral Symphony," "Choral Fantasia," &c.) but of Bach and of Mozart, far more tender of the voices of the executants than was the tyrannic Beethoven. The rise in pitch began at the Vienna Congress in 1815, when the Emperor of Russia presented new and sharper wind instruments to an Austrian regiment of which he was colonel. In 1828 another Austrian regiment received even sharper instruments still. The theatres, greatly dependent

upon the bands, were obliged to adopt their pitch. Gradually at Vienna the pitch rose from $a' = 421.6$ (Mozart's pitch) to $a' = 456.1$, or nearly three-quarters of a tone. The mania spread throughout Europe. The pitch reached $a' = 448$ at the Paris opera in 1858, and the musical world took fright; the Emperor Napoleon III. appointed a commission of professional musicians of the greatest eminence, and the result was the establishment of the diapason normal in 1859.

The rise was due in England almost entirely to the authority of one man of genius, Sir Michael Costa, who raised the Philharmonic band from Sir George Smart's pitch of $a' = 433$ (itself ten vibrations above the original fork of 1813) to 454, and who caused the Albert Hall organ to be tuned to $a' = 455$. It needs the arising of an equal authority with opposite views to undo the evil Sir Michael, with the best intentions, unhappily accomplished.

PITCH-BLENDE, a blackish mineral, with pitch-like lustre, found associated with tinstone in Cornwall, and with lead and silver ores in Saxony. It is an oxide of the rare metal, uranium, and is employed in enamel-painting and glass-staining; to the latter it imparts a delicate yellow colour. In combination with a certain amount of copper it yields a blue pigment occasionally used in paper-making.

PITCHER PLANTS is the name given to some remarkable *INSECTIVOROUS PLANTS*, which have a portion of the leaf modified into the form of pitcher. These plants belong to very distinct orders of dicotyledons, Sarraceniacæ, with three genera—*Sarracenia*, *Darlingtonia*, and *Heliamphora*; Nepenthacæ, with the single genus *Nepenthes*; and the genus *Cephalotus*, which is placed by Bentham and Hooker among the Saxifragæ.

Sarracenia.—There are about six species of this genus inhabiting bogs near the coast of the Atlantic States of the Union; one species, however, extends westwards as far as Minnesota. The pitchers are formed by the long trumpet-shaped radical leaves, which exhibit considerable variety in size, form, and colour. The tubular pitcher is surmounted by a large overhanging lobe or lid, which never completely closes the pitcher, and is regarded by some as the blade of the leaf, the pitcher itself being formed by the expanded petiole uniting at its edges to form a tube. The lid and mouth of the pitcher, and usually also a track leading up from the ground along the broad wing of the tube, are provided with numerous glands secreting honey, which attract insects to their doom. Inside the pitcher is a smooth polished surface secreting a fluid which fills the bottom of the tube, and above and below it are sharp stout hairs that allow the insect to descend, but effectually bar its return. The fluid has no digestive power; its function is rather to stupefy and drown the captives and hasten decomposition, and thus provide for the nourishment of the plant. The *Sarracenia* is not permitted to enjoy the whole produce of this singular net, for some insects drop their eggs into the tube, so that their larvae may feed on the decomposing bodies of insects therein.

Darlingtonia.—Only one species of this genus is known, *Darlingtonia californica*, growing in marshy places in California. [See LEAF, Plate III., fig. 8.] The radical leaves are from 12 to 18 inches long, tubular, dilated upwards, and twisted on the axis about half a turn. The summit of the pitcher is vaulted and curved over the small orifice like a hood, and from it hangs down a large bilobed appendage, brightly coloured and provided with honey glands. The inside of the tube is similar to that in *Sarracenia*, and the fluid found at the bottom drowns and decomposes the insects which have been lured into the net.

Heliamphora.—The single species *Heliamphora nutans*, found in muddy places in Guiana, has its leaves in the form of an open pitcher with an oblique mouth, and a small concave appendage at the apex. [See LEAF, Plate

III., fig. 4.] The inner surface of the tube is like that of *Sarracenia*.

Nepenthes.—About thirty-six species of this genus are known from the tropics of the Old World, the majority being found in the Malay Archipelago. The pitchers in this remarkable form are borne at the extremity of long tendril-like appendages, the prolonged midribs of the broad alternate leaves. [See LEAF, Plate III., fig. 6.] Sir Joseph Hooker has shown that the pitcher is a modification of the water-secreting gland found at the apex of the midrib of many leaves. In the adult plant the pitcher forms a long narrow tube, the mouth of which is kept open by a thickened rim, which secretes honey, and is sometimes provided by a row of incurved hooks to prevent the escape of insects. The mouth is provided with a honey-secreting lid attached by a sort of hinge which does not open till the leaf is fully developed and the watery secretion has been deposited at the bottom of the tube. Within the tube are rows of strong hairs pointing downwards. In the young plant and on the lower leaves of adult plants the pitchers are shorter, broader, and provided with two fringed wings. The fluid secreted by the pitchers of *Nepenthes*, unlike the secretion of the *Sarraceniaceæ*, has great digestive powers, even dissolving, as was proved by Hooker, cartilage. Lawson Tait has found in this fluid *droserin*, the digestive ferment of the common sundew (*Drosera*) and other insectivorous plants which possess the power of true digestion. The pitchers are sometimes as much as 20 inches long; they are green in colour, variously tinted, and mottled with red or purple. Mr. Wallace ("Malay Archipelago") tasted the water of the pitcher-plants growing at Mount Ophir, near Malacca, and found it very palatable, though rather warm.

Cephalotus.—This Australian genus contains a single species, *Cephalotus follicularis*, inhabiting swampy places in King George's Sound. Besides leaves of ordinary shape, some are dilated to form little pitchers, resembling those of *Nepenthes*, but only from 1 to 3 inches long. Intermediate stages between these and the ordinary leaves have been observed. [See LEAF, Plate III., fig. 5.] The pitchers are green, spotted with purple and brown, and provided with a close-fitting lid; while round the mouth is a thickened and regularly grooved rim. The secretion of the pitchers has digestive powers.

PITCH-PIPE, a pipe used for setting the pitch for unaccompanied vocal performances. The old pitch-pipe was on the plan of a small organ pipe with a long stopper, which could give a certain variety of pitch by being inserted into the pipe more or less, so that it varied as to its sounding length. A better and more modern form (chromatic pitch-pipe) is a very small free-reed pipe (on the principle of the concertina or harmonium), the reed or vibrator of which can be controlled, so that the length actually free to vibrate can be varied, and the note it gives forth correspondingly altered. This is a very convenient and portable, and also a fairly accurate, pitch-pipe. The surest means of giving a pitch is, however, the tuning-fork, which remains practically exact under all temperatures and with all methods of sounding.

PITCH-STONE, an ancient glassy lava, with a conchoidal fracture, and having a pitch-like lustre. It is usually greenish-black in colour, though occasionally brown, and is most typically developed in Britain in the Isle of Arran. The rock is filled with innumerable incipient crystals (microliths) of microscopical dimensions, and when sections are examined under a low power, these crystalline needles are observed to present a very characteristic grouping. They are aggregated into various moss- and fern-like patterns, as shown in the drawing of the magnified section in fig. 2, Plate I., GEOLOGY, vol. vi.

PITH is the parenchymatous cellular tissue found in the centre of the stems and branches of dicotyledonous plants. In the young stem and in twigs the pith is of

considerable importance in the economy of the plant, stored as it is with starch and other nutrient matters. As the wood grows it is less necessary, and in many cases the cells lose their contents and become filled with air, or else become more or less woody. Occasionally closed fibro-vascular bundles with the bast encircling the wood occur within the pith.

PITHOM, the *Succoth* of the Bible, and the *Ero* of the Romans, an ancient town of Egypt, represented by the mounds of Tel-el-Maskhuti. The ruins offer interesting evidence in regard to Bible history; and it is curious that while the town was well built, the bricks are of three qualities, the best being mixed properly with straw; the next, when straw was no longer forthcoming, being made with reeds (translated "stubble" in the Bible), and the worst consisting of mere mud, when the last of the reeds were used up. The history of the place begins with Rameses II., about B.C. 1400, and ends with a Roman milestone of Galerius Maximian and Severus, about A.D. 306 or 307.

PITT, WILLIAM, EARL OF CHATHAM, was the second son of Robert Pitt, Esq., of Boconnoc, near Lostwithiel, in Cornwall, by Harriet Villiers, sister of the Earl of Grandison (an Irish Peer), and the grandson of Thomas Pitt, governor of Madras. William Pitt was born at Boconnoc, on 15th November, 1708. He was educated at Eton, whence he went in 1726 to Trinity College, Oxford. On leaving the university, he obtained a cornetcy in the Blues, and entered Parliament in January, 1735, as one of the representatives for the borough of Old Sarum, which was the property of his family. He joined the Opposition, at that time headed by Frederick, prince of Wales. The part which he took in the debates led to his being deprived of his commission; but he was appointed a groom of the bed-chamber by the Prince of Wales. He took an active and prominent part as a debater in the discussion of the successive motions directed against Walpole in January and February, 1741, and became eminently distinguished for his power of sarcasm, brilliant declamation, and imposing elocution. In 1746 he was appointed one of the joint vice-treasurers for Ireland, and was subsequently promoted to the office of paymaster-general. To the next Parliament, which met in November, 1747, he was returned for Seaford, one of the Cinque Ports.

A few years previously his pecuniary circumstances had been rendered much easier by a legacy of £10,000, left to him by the Duchess of Marlborough. He had thereupon resigned his post in the household of the Prince of Wales, and indeed had separated himself entirely from his royal highness, who still remained the recognized head of the Opposition, such as it was, till his death in March, 1751. The discussions upon the Regency Bill, which in this session followed the death of the Prince of Wales, first originated a rivalry between Pitt and Henry Fox (afterwards the first Lord Holland).

To the new Parliament, which met in November, 1754, Pitt was returned for Aldborough in Yorkshire. On 15th November, 1755, Fox was appointed secretary of state, and five days after Pitt and his friend Grenville were dismissed. But after about another year, Newcastle, already deserted by Fox, found it necessary to resign his position. In this crisis the king found it necessary to summon the popular favourite; and though the office of first lord of the treasury was given to the Duke of Devonshire, Pitt, appointed secretary of state, became the actual premier in December, 1756. He was now returned both for the town of Buckingham and for Okehampton, and elected to sit for the latter. But in April, 1757, his Majesty abruptly sent Lord Temple his dismissal from the post he held of first lord of the admiralty, an act which was immediately followed, as must have been designed, by Mr. Pitt's resignation. For two months and a half the country remained

without a government, during which time the court applied in vain to almost every section of party men in the country, and the result was that before the end of June Pitt was again premier, with the seals of secretary of state. Being now firmly established in power he was able to carry out his war policy with vigour and persistence, and his skilful direction was rewarded by a series of brilliant victories over the French in Europe, Africa, India, and Canada, while the British fleet almost drove the French flag from the sea.

The accession of George III., however, brought with it the ascendancy of Lord Bute and his friends; and a few weeks before the meeting of Parliament, Mr. Pitt, on the refusal of his colleagues to acquiesce in his proposition of declaring war against Spain, resigned, along with his friend Earl Temple. On his retirement a pension of £3000 a year for the lives of himself, his wife, and his eldest son, was conferred on him, and his wife was made a peeress with the title of Baroness Chatham. These honours and rewards did not increase his popularity.

Without engaging in any factious opposition, but on the contrary giving a general support to the government, the great statesman now directed his eloquence against certain of their measures with all his old energy and fervour. Various attempts were made to induce him to enter the cabinet again, but he refused; and he declined even to take office with the Rockingham administration, although their measures generally had his support; but, as he said in the debate on the address in January, 1766, he could not give them his confidence, "a plant of slow growth in an aged bosom; and youth was the season of credulity."

At length he was invited to frame a new administration, in which he endeavoured to enlist the leaders of the different political parties (August, 1766). England, however, does not love coalitions, and the new cabinet was ridiculed by Burke as a "tessellated pavement without cement." What most astonished the public in the whole arrangement was the manner in which Pitt disposed of himself: he took the almost sinecure office of lord privy seal, and, leaving the old scene of his glory, went to the Upper House as Viscount Pitt and Earl of Chatham.

This rickety administration was in a state of confusion and embarrassment all the time it existed. Lord Chatham withdrew from all share in the conduct of affairs, and on 16th October, 1768, sent his friend Lord Camden to the king with a resignation of his office.

In 1770 he again appeared in his place, and occasionally took as prominent a part in debate as he had ever done in his best days. At last, 7th April, 1778, after he had spoken once on a motion for an address to the king on the state of the nation, he attempted to rise again to reply to some observations of the Duke of Richmond, when he dropped senseless into the arms of those beside him. He was carried home to his house at Hayes, in Kent. He never again rose from his bed, and died 11th May, 1778, in the seventieth year of his age.

All the enthusiasm which had been stirred by his name in former days was revived for the moment by his death; and to a funeral and a monument in Westminster Abbey at the public expense, were added a grant of £20,000 for the payment of his debts, and a pension of £4000 a year to his descendants.

The best life of Lord Chatham has been written by the Rev. Mr. Thackeray, "History of the Earl of Chatham," two vols. 4to. An admirable sketch of his career is also included in Lord Macaulay's "Critical and Historical Essays." Of his own writings nothing has been given to the world except a small volume of letters addressed to the son of his elder brother, afterwards Lord Camelford, which was published by the late Lord Grenville; and his "Correspondence," in four vols. 8vo.

PITT, THE RIGHT HONOURABLE WILLIAM, second son of the first Earl of Chatham, was born at Hayes, in Kent, 28th May, 1759. His elementary education was conducted at home, under the Rev. Edward Wilson, afterwards canon of Windsor, and anxiously superintended by his father. He was sent in 1773 to Pembroke Hall, Cambridge, where, under Dr. Protzman, afterwards Bishop of Winchester, he was soon distinguished for his talents and attainments. After leaving Cambridge Mr. Pitt visited France. On his return to England he entered himself at Lincoln's Inn, and he was called to the bar in 1780. His connection with the law was however of very short duration, for after having travelled the western circuit only once or twice, he was returned to Parliament for the borough of Appleby, and from this date his original profession was given up for the House of Commons and a political career.

He took his seat 23rd January, 1781, and his first appearance in debate was on 26th February, on the motion for the second reading of Mr. Burke's famous bill for the regulation of the civil list establishments. He gave his hearty support to the measure, "and," says the report, "in a speech directly in answer to matter that had fallen out in the course of the debate, displayed great and astonishing powers of eloquence." He afterwards spoke repeatedly on the side of the Opposition in the course of this and the following session, before the termination of which it may be said that he had taken his place with Burke, Fox, and Sheridan (the last also a member of only the same standing with himself), in the front rank of the debaters of the day.

In was on the 7th May, 1782, that he made his first motion for the reform of the representation of the people. The motion was defeated by an inconsiderable majority, but the mover continued for some years to advocate the opinions which he announced on this occasion. Under the Shelburne administration Mr. Pitt held office as chancellor of the exchequer. The alliance of Whigs and Tories, however, which drove this ministry from office, was now opposed by another body of similar composition, formed by the Shelburne Whigs and the Tories who, seceding from Lord North, professed themselves the friends and supporters of the court. Of this opposition Pitt was the recognized leader in the House of Commons. Among other manœuvres to which he had recourse, with the view of annoying and damaging the government, was the renewal of his motion for parliamentary reform. The effect was to array Fox and Lord North against each other in the debate and division; but the motion, nevertheless, was negatived in rather a full house by a majority of nearly two to one. The serious opposition to the government did not begin till the next session, when Fox brought forward his India Bill; and when, in 1783, the king had procured its defeat in the Lords, and followed up his advantage by dismissing Mr. Fox and Lord North, Mr. Pitt was appointed prime minister, with the offices of first lord of the treasury and chancellor of the exchequer. He was scarcely twenty-four years old when he undertook the responsibilities of government, and though he had the voice of the people in his favour, he had to contend against a strong opposition in the House of Commons. His policy during this remarkable contest was very masterly. Without immediately dissolving Parliament, he suffered the opposition to damage themselves almost irretrievably in public opinion; and having succeeded in reducing their majority from about sixty to one or two, he then sent them back to their constituencies to be one-half of them rejected at the general election, and ridiculed as "Fox's martyrs."

Mr. Pitt's biography from this date is little else than the history of the public affairs of the kingdom. He continued at the head of the ministry for about seventeen years—a most eventful and important period, in the course of which

the relations of parties were altogether changed, and this country and Europe were suddenly and violently translated from a state of profound peace into the most general and most convulsive war that had been known in modern times. [See NAPOLEON I.; GEORGE III.] The elder Pitt owes his chief fame as a minister to his conduct of the war in which he found the country involved on his first accession to power; but it is unfortunate for his son's political reputation that he should have been transformed from a peace into a war minister. He did not understand foreign policy. He trusted too much to coalitions and subsidies, and wasted the strength of the empire in numerous little expeditions which were aimed at no vital point, and were, moreover, grossly mismanaged. The establishment of a new constitution for the East India Company (1784), the establishment of a new sinking fund (1786), the arrangement of a commercial treaty with France on very liberal principles (1786), the consolidation of the customs (1786), acts passed for the relief of the Roman Catholics in England, Scotland, and Ireland (1791-92), were the administrative innovations that chiefly distinguished this period, and which were understood to owe their origin mainly to the premier. In 1785 he again brought forward the subject of the amendment of the representation of the people in Parliament; but he did not call in the aid of his authority as minister to insure the success of his motion, which was negatived by a considerable majority, and which he never renewed. Afterwards, when the question of reform was introduced by Mr. (afterwards Lord) Grey, the proposal found in Mr. Pitt one of its most determined opponents.

Almost the only memorable legislative measure of the latter years of his first ministry was the union with Ireland, which was effected in 1799. The disappointment of the expectations which he considered himself entitled to entertain of the abolition, or at least very great mitigation, of the penal and disabling laws affecting the Roman Catholics, was the reason which he assigned to the king for retiring from office soon after the accomplishment of this important transaction. He and his friends resigned office in March, 1801.

For some time Mr. Pitt gave his support to the administration of Mr. Addington; but when the incompetency of the new cabinet became apparent, he declared against it, and in May, 1804, he became again prime minister. He remained at the head of affairs till his death, 23rd January, 1806, in the forty-seventh year of his age. His last words were, "Oh, my country! how I leave my country!" The overthrow of the new coalition which he had succeeded in forming against France, Napoleon's victory at Austerlitz, and the vexation arising from the impeachment of his friend, Lord Melville, are supposed to have been the causes which accelerated his end.

Mr. Pitt was probably the most powerful minister who has governed the country since the Revolution. He possessed great talents and great virtues. He was pre-eminently qualified for the office of a parliamentary leader, and throughout his whole career was the idol not only of his party, but of his country. He was certainly ambitious, but his love of power had in it nothing mean, paltry, or low. His patriotism may not have been always far-seeing and sagacious, but it was at all times pure and self-denying. He was upright, straightforward, and truthful, while his private life was without a stain, and he was exemplary and affectionate in all his domestic and social relations. His manner in public and before strangers was somewhat haughty, stiff, and reserved, but among his intimate associates he was amiable, affectionate, and even playful. His oratory was of a high order, and in sentiment, in language, and in delivery evidently bore the stamp of his character. It wanted, indeed, the earnestness and fire of his father's eloquence; it had none of Burke's splendour of imagination,

tion, or of Fox's impassioned argument; but it was better adapted than the oratory of any of these great masters for its sphere of action—the British House of Commons. His unbroken fluency and lucid arrangement, the clearness of his statements, his forcible appeals to reason and feeling, and especially the splendour of his declamation and his powers of sarcasm—set off as these were by the majesty of his diction, the depth and fullness of his sonorous voice, and the dignity of his manner—placed him in the foremost rank of parliamentary debaters, and contributed greatly to establish and perpetuate that unrivalled pre-eminence which he so long enjoyed, both in the legislature and in the country.

PITTAKOS (Lat. *Pittacus*), one of the so-called Seven Wise Men of Greece, was born at Mytilênê, in the island of Lesbos, about 652 B.C. He delivered his native island from the tyranny of Melanchros (B.C. 612), and defended it from the Athenians. In return for this he was elected chief of the island. His administration is said to have been attended with success. In B.C. 580 he resigned, and died B.C. 570, at the age of eighty-two. A few fragments of his poems are still extant. Many of the maxims of practical wisdom current among the ancients were ascribed to Pittakos.

PITTOSPORÆE is an order of dicotyledonous plants belonging to the group *POLYETALÆE*. The species are trees or shrubs chiefly confined to the Australian region, but some are Indian and African. Some are cultivated in Europe as ornamental plants. Many of them contain abundance of resin, which gives their berries a disagreeable flavour, in spite of which they are eaten by the natives of Australia. The leaves are simple, alternate, exstipulate, and the flowers regular, solitary, or disposed in clusters, and usually white, blue, or yellow. The sepals and petals are five in number; the stamens are five, alternate with the petals; the ovary is two-celled, or incompletely two to five-celled. The fruit is a capsule or a berry; the seeds are usually numerous, immersed in a glutinous or resinous pulp. About ninety species are known, of which fifty belong to the typical genus, *Pittosporum*.

PITTSBURG, a city of Pennsylvania, United States of America, now practically one with the city of Alleghany, situated at the confluence of the Monongahela and the Alleghany rivers, 160 miles west of Harrisburg. Its prosperity is owing to its position in one of the richest coal and iron fields in the New World. From its numerous factories it has been called the American Birmingham; but it is a Newcastle and a Birmingham combined. It supplies 1,500,000 tons of coal a year to the Mississippi Valley, and its busy population keeps in operation many glass-works, cotton-mills, iron-foundries, iron and steel works, manufactories of machines, engines, boilers, cylindrical tubes, cannon, nails, spikes, and white-lead. It possesses about 120 churches, numerous substantial bridges, an arsenal, a court-house, a theatre, schools, colleges, and the usual public buildings. Situated at the head of the Ohio, which is formed by the junction of the Monongahela and Alleghany, it has steam communication to all parts of the great Mississippi Valley, and can transmit its products by water to New Orleans for exportation to Europe. A system of railways and canals connects it with Philadelphia, Cleveland, and other important towns. The surrounding country is picturesque; and the high grounds in the neighbourhood are sprinkled with handsome villas. Pittsburg occupies the site of Fort Pitt, and the more ancient French fort Duquesne, which was captured by General Forbes and the British in 1758. The city was incorporated in 1816. In 1845 it suffered severely from an extensive fire. Much property was destroyed and several lives lost in Pittsburg during the great railway strike in 1877. The population in 1880 was 156,889. In 1870 it was only 86,076.

PITYRIASIS (Gr. *píturon*, bran) is a disease of the skin in which regular patches of the cuticle appear covered with thin bran-like scales or with particles of a fine white powder, which, as fast as they fall off, are succeeded by others. The commonest form of this disease is that called *Pityriasis Capitis*, or Dandruff. It affects chiefly the scalp and eyebrows, and is most frequent in children, in whom it originates either from generally disordered health or from mere neglect of cleanliness. It occurs also on the face and sometimes on other parts of the body in adults and old persons after exposure to the sun or a cutting wind, and it usually accompanies the commencement of baldness. In the majority of cases pityriasis is a trivial affection, and one that speedily yields to appropriate treatment. The latter must include the exhibition of general tonics directed towards improving the nutritive function of the skin, and the use locally of the oxide-of-zinc ointment or the red oxide-of-mercury ointment in a diluted form.

PIUS was the name assumed by ten of the Popes.

PIUS I., tenth bishop of Rome, contemporary with the Emperor Antoninus Pius, is said to have been a native of Aquileia. The accounts of the duration of his episcopate vary. Fifteen years is the most common period assumed, i.e. 142 to 157. The small pieces attributed to him are generally apocryphal.

PIUS II. (*Æneus Silvius Bartolomæus de Piccolomini*), was born 18th October, 1405, at Corsignano in the state of Siena. After completing his studies, and proving himself an elegant Latin scholar and good poet, he became secretary of Domenico da Capraia, bishop of Fermo. With him he repaired to the Council of Basel, 1432. He then passed into the service of Bishop Nicodemus Scaligerus, of the princely house of Verona, with whom he went to the diet of Frankfurt, 1432. His third master was Bartolomæo Visconti, bishop of Novara. In 1435 he went again to Basel, with the Cardinal di Santa-Croce, the Pope's cardinal-legate. He afterwards accompanied the same dignitary to France, to attempt to reconcile that country with Henry VI. of England. Piccolomini was sent by himself to Scotland on a confidential mission, and his account of London, of England, and of Scotland, is as interesting as it is valuable. He travelled disguised as a merchant, and underwent all kinds of peril in the wild times then prevailing.

He was one of the cleverest and boldest men of letters of the time, and consequently when he returned to the Cardinal di Santa-Croce at Basel, he was almost at once singled out as secretary. He was frequently chosen as ambassador, as president, &c., and was the life of that great assembly. The main object of the Council of Basel was to assert the supremacy of the church in council over the Pope, and no one was bolder than Piccolomini against Pope Eugenius IV. when the council suspended the latter, and ultimately deposed him. Piccolomini became secretary of the new pope, elected by the council with the title of Felix V., who sent him as ambassador to Frederick III. to Frankfurt in 1442. The emperor was so well pleased with Piccolomini that he invited him to become his secretary. In this situation he composed several of his works, but seems to have been poorly paid. He took orders while with the Emperor, and was appointed to several country parishes in succession. At last Frederick sent him as his ambassador to Pope Eugenius, who received him in a very friendly way, and forgave all his past errors (1446). He now entered into the service of Eugenius, and became his leading instrument at the court of Vienna. From this time he advocated the papal claims as stoutly as he had done those of the council before. For daring and splendid services against his old friends the Council of Basel, among which, on the confession of Piccolomini himself, forgery of the papal instructions at one pinch of great severity must be included, Eugenius on his deathbed created him Bishop

of Trieste. The Antipope Felix V. was induced by Piccolomini to retire with a handsome income and a cardinalate, and the last council which has striven for supremacy with the Pope then quietly dissolved. Consequently Pope Nicholas V., who succeeded Eugenius, treated Piccolomini with still greater favour, and conferred upon him various offices, making him Bishop of Siena and sending him as nuncio to Germany and Bohemia. When Frederick III. was solemnly crowned at Rome in 1452, he was accompanied by Piccolomini as orator, who delivered an oration at Rome before the Pope, the Emperor, and the assembled consistory, in which he lauded Nicholas with praise, and in the name of the emperor called for a crusade against the unbelievers, i.e., the Turks. But this measure could not be effected. Pope Calixtus III., who succeeded Nicholas, made Piccolomini a cardinal; and on his death, in 1458, the influential cardinal was elevated to the papal see as Pius II.

During his pontificate he appeared exceedingly anxious to unite all the Christian princes of Europe against the Turks. For this purpose he assembled them at Mantua to devise a plan of attack in common. But Germany and France seemed indisposed to join in the crusade, and the negotiations proved fruitless. After endless negotiations, conducted amidst distractions of all kinds arising out of the complications of his chequered career (which he finally settled by a bull condemning his own writings in favour of the pretensions of councils and his early conduct in general) Pius II. succeeded in starting a crusade. In 1464 an army, composed of various peoples, assembled at Ancona to operate against the Turks. The Pope was greatly chagrined to find such a small armament and an insignificant Venetian fleet. He died before the fleet sailed, 15th August, 1464. He was succeeded by Paul II.

The writings of Pius are numerous, but there is no complete edition of them. The Basel edition, in one volume folio (1551), is still the fullest. His historical and geographical works are the most valuable. Pius II. was an accomplished scholar and divine. His talents were excellent, and he had cultivated them most diligently in the earlier part of his life. He had also large experience of men and things, had visited many countries in various capacities, and seen human nature in most of its phases. His early life, as he himself freely confesses, had been dissolute and debauched. The writings of *Æneus Sylvius* are valuable for the history of his time. In 1883 Signor Cugnani published some very valuable fragments preserved in the Chigi Palace Library at Rome, and suppressed by the original editor of the Pope's works as being too frank in their confessions. The account of the concave which elected him is particularly clever.

PIUS III. (*Francesco Todeschini*), born in 1439, was elected pope 22nd September, 1503, in succession to Alexander VI., twenty-five days after he died. He was a sister's son of Pius II. He commissioned the building of the famous library attached to the cathedral at Siena and ornamented all round with magnificent frescos of large size, painted by Pinturicchio on subjects in the life of Pius II. Portions of these fine works are said to be by Raffaele, who aided Pinturicchio. Pius III. was succeeded by Julius II.

PIUS IV. (*Giovanni Angelo de' Medici*, of Milan, not the famous Florentine family of Medici) was born in 1499, and raised to the papal see in 1560. His first measures were mild and tolerant. He proclaimed a general amnesty for all that had happened in Rome after the death of Paul IV., and instituted proceedings against the Caraffas, grandsons of the late pope, some of whom were executed. In 1561, at Easter, he convoked the Council of Trent, whose sittings had been suspended; but the first sitting under Pius IV. did not take place till 18th January, 1562. The difficulties of the Pope's position in this council were numerous, but he issued triumphant from the conflict. All the reforms decreed related to church discipline, a better order

of worship, a more thorough preparation of the clergy, and a stricter obedience to the Pope. The great council closed in December, 1563, and Pius confirmed its decrees in January, 1564—issuing the famous creed, which has ever since ruled the Roman Catholic Church, 13th November, 1564. It is called sometimes the Tridentine Creed, sometimes the Creed of Pope Pius IV. Pius IV. died 9th December, 1565. He was an able man—generous and politic—who inaugurated a new era of catholicism.

PIUS V. *SAINT (Michele Ghislieri)*, born in 1504 at Rosco, near Alessandria in Liguria, was chosen pope 8th January, 1566, in succession to Pius IV. His manner of life and education prognosticated the future career of Pius V. He was a strict inquisitor, who had held most important offices in connection with the terrible tribunal in various places, as well as in Rome; had been brought up as a Dominican monk; and had shown himself a rigid disciplinarian among the clergy, monks, and nuns. His own life was irreproachable, showing that he was earnest and devoted to the church's interests. He carried into execution the enactments of the Tridentine Council. Maximilian II. of Germany and Philip II. of Spain allowed the new discipline to be introduced into their dominions; it spread from diocese to diocese, and became general. The moderation exhibited towards Pius appears from the fact that though he reintroduced the bull *In cæna Domini*, which exalts the power of the Pope to the highest pitch, it did not lead to a war with any sovereign. This bull was issued with new additions in 1568; and ordered to be read in every church every Thursday before Easter. The united protests of the Roman Catholic states, however, ultimately effected its withdrawal. The measures of Pius for the extinction of heresy and suppression of Protestantism were unparading. His bull against Elizabeth of England had no effect (1570). Philip II. was encouraged in his oppressive measures in the Netherlands. Charles IX. of France was even assisted with a small army, to be employed in rooting out the Huguenots. In Italy, where the Inquisition carried on its rigorous measures, learning declined, and books ceased to be printed. He expelled the Jews from the Papal States, except only Rome and Ancona. Pius V. made great efforts to promote the great Christian league, and lived to see a victory gained over the Turks at Lepanto, 7th October, 1571, by the Spanish, Venetian, and Papal fleets combined, under Don Juan of Austria. He died on the 1st of May, 1572. He was a sincere though bigoted man, and was both learned and a patron of learning. He was beatified by Clement X. 1st May, 1672, and canonized by Clement XI. 24th May, 1712. His successor was Gregory XIII.

PIUS VI. (*Giovanni Angelo Braschi*) was born 27th December, 1717, at Cesena, and was chosen pope in 1775. His general policy consisted in withstanding the power of the great Catholic courts over the affairs of the church in their territories, and in attempting to restore the papal authority, which had declined during the preceding reigns of Clement XIII. and XIV. This policy, however successful it appeared to be at first, was disastrous in the end. Early in his reign Pius VI. went in person to Vienna to converse with the Emperor Joseph II., who had been making many liberal reforms in Austria, and tried to win him over (1782). The journey in question was fruitless, though Pius stayed a month at Vienna. The Pope had also a dispute with Joseph's brother, Leopold I., grand-duke of Tuscany, on the subject of reforming monastic institutions in his dominions, which had become corrupted. Finally, the breaking out of the French revolution disturbed the friendly relations between France and the Pope. The measures of the National Convention in 1790, relative to the church, were disastrous to its authority. Pius excommunicated Talleyrand, 1791, and was in consequence burnt in effigy at Paris. Later on he was threatened with war.

The threat, however, was not carried out till General Bonaparte compelled him to submit to terms, on the 23rd June, 1796, at Bologna, and afterwards granted him peace at Tolentino, 19th February, 1797. In the former case Pius had to pay twenty-one millions of livres; in the latter thirty millions, besides being compelled to renounce the northern provinces of Italy. A tumult in the streets of Rome, in which General Duphot, attached to the French embassy, was shot by the papal soldiers, served as a pretext for taking possession of the city; and Berthier was ordered by the Directory to march upon it at the head of the French army, 15th February, 1798. The Roman republic was proclaimed in the Capitol, and Pius was commanded to renounce his temporal sovereignty, but refused. He was therefore carried out of the city, on the night of the 19th–20th February, 1798. He was first taken to a convent at Siena, where he lodged three months. The next ten months he spent among the Carthusian monks at Florence. In April, 1799, although ill, he was hurried across the Alps by the pass of Mont Gendève in a litter, amid deep snow; thence to Grenoble. At the latter place his illness had so far increased as to exempt him from further travelling, and he died there at the age of nearly eighty-two, 29th August, 1799. In 1801 Pius' remains were transferred to St. Peter's at Rome. A noble statue of the Pope kneeling, with outstretched hands, in the attitude of prayer, is placed before the bronze gates leading to the tomb of St. Peter under the high altar. It is one of the masterpieces of Canova. The principal part of the great Vatican Museum, called Museo Pio-Clementino, is due to this pope in conjunction with his predecessor, Clement XIV. It is the noblest collection of antiquities in the world. Early in his reign Pius VI. drained the Pontine Marshes, and added several fountains and other embellishments to the city of Rome.

PIUS VII. (*Diarna Luigi Chiaramonti*) was born on 14th August, 1742, at Cesena, of a distinguished family. In 1772 Pius VI. appointed him abbot, subsequently bishop, of Tivoli; and in 1785 cardinal and bishop of Imola. On the 14th March, 1800, he was elected successor to Pius VI. in the papal chair. The conduct of the new pope was in accordance with his known character for piety, moderation, and devotion to duty. Pius VII. seemed likely to restore the ruined papacy. He lowered taxes, abolished pernicious monopolies, set on foot new works to give the poor employment, and showed an honest zeal for the good of the people generally. On 15th July, 1801, he concluded a concordat with France, and received again the possession of the Papal States in November. Concordats were also entered into with the Ligurian and Italian republics. In 1804 Pius reinstated the Jesuits in Sicily. After much anxious deliberation he determined to comply with Bonaparte's invitation to crown him emperor, and with this view entered Paris 28th November, 1804, with much pomp. Napoleon was publicly anointed by Pius, but crowned himself. After many fruitless negotiations, oral and otherwise, in which Pius sought to induce Napoleon to restore the papal power, he returned to Rome, 16th May, 1805. At every stage of his journey, and particularly at Lyons and Turin, the people thronged to do him honour on their knees. Notwithstanding this, and the esteem in which Napoleon professed to hold him, it soon became apparent that an open breach between them was approaching. Matters were brought to a crisis by the Pope's refusal to acknowledge Napoleon's brother Joseph as king of Naples, and by the opening of his ports to the English. On the 2nd February, 1808, Rome was taken possession of by French soldiers. On the 17th May, 1809, the states of the church were formally incorporated with the empire, and Rome declared a free imperial city. Two bulls, dated 10th and 11th June, were issued against those who had so grievously invaded the rights of the church. This brought

upon the Pope the vengeance of General Radel, who broke into his room by night, and required him to renounce his civil power. On his refusing, the general took him to Grenoble, thence to Savona. In 1812 he was conducted to Fontainebleau. During all this time he had set himself resolutely against the will of the emperor, and resisted his demands. He refused canonical confirmation to the French and Italian bishops nominated by Napoleon, and disapproved of the latter's separation from Josephine and second marriage. On the 25th January, 1813, Napoleon forced Pius to subscribe the concordat, according to which he was to receive two millions of francs yearly in lieu of his former possessions—an act which virtually amounted to a renunciation of his claim to the states of the church. After Napoleon's fall he returned to Rome 24th May, 1814, amid great rejoicings, and took possession of all the states of the church, with a few exceptions. He at once restored the order of the Jesuits. He gave a new constitution to his territories on the 6th July, 1816, which was on the whole not illiberal. His administration was marked by moderation and tolerance. Rome became even an asylum for unfortunate kings and families, the family of Napoleon among others, and all political opinions were allowed. Rome grew more flourishing, and Pius VII. had the gratification of adding the Chiaramonti Gallery and the fine Braccio Nuovo to the great museum of the Vatican. These contain some of the greatest treasures of sculpture left to us from antiquity. It is to Pius VII. also that the famous Vatican Picture Gallery is due; for he had the happy idea to collect the masterpieces returned from the French spoilers at the fall of Napoleon, instead of distributing them to the various churches. Out of the forty-two priceless works which form this splendid collection exactly half have been exhibited in the Louvre! Pius died from effects of a fall on the 20th August, 1823, at the age of eighty-one. He was a man of simple and unostentatious habits, humble, modest, benevolent, and pious. His lot was hard, and he bore it magnanimously. His persevering resistance to Napoleon's is a thing to be admired.

PIUS VIII. (*Francesco Nuviero Castiglione*) was born at Cingoli, 20th December, 1761, made bishop of Montalto in 1800, and in 1816 a cardinal. On 31st March, 1829, he was chosen successor to Leo XII., though at the time very feeble. He had the satisfaction of seeing Catholic emancipation accomplished in England. A concordat with Holland was also established. He died 30th November, 1830. Pius VIII. had the reputation of being the most learned canonist of his time.

PIUS IX. (*Giovanni Maria Mastai-Ferretti*), commonly called *Pio Nono*, was born on the 13th May, 1792, at Sinigaglia. He was the fourth son of Count Jerome Vellazi, and of honourable and ancient family. In early life he had a desire for the military profession, and came to Rome in 1815 during the reign of Pius VII., but was not admitted into the papal guard because of his delicate health. Accordingly he studied for the sacred profession, was ordained priest in 1823, and went to Chili to attach himself to the mission there in that year. In 1825 he returned and devoted himself with great zeal to the care of the poor and sick, so that Leo XII. made him an hospital director. In 1827 he was nominated archbishop of Spoleto. In 1832 Gregory XVI. appointed him archbishop of Imola, and in 1840 he became a cardinal. On the 16th July, 1846, he was elected pope. Great expectations were entertained from his elevation because of his upright and benevolent character; especially as the rule of Gregory XVI. had been severe. After his elevation he issued a general amnesty in favour of all who had been banished or imprisoned for political offences, by which 15,000 persons were affected. Soon after positive reforms were set on foot. Commissions were issued for revising the laws; an edict relieved the press; a civil guard was

organized, and the city received a new municipal constitution. The year 1848 brought with it other important reforms, especially the measure by which a sort of chamber of peers and a chamber of deputies were associated with the pope and cardinals in civil matters. But the revolutionary spirit that pervaded Europe in that memorable year frightened the Pope. He began to draw back in his policy, and to resist the innovating spirit of reform. His popularity soon failed, when the sanguine hopes raised at the beginning of his pontificate were disappointed. He had never been a reformer on principle. All his good measures sprang from a disposition naturally mild and gentle, inclined to moderation and beneficence, rather than from political sagacity or sound judgment. His reactionary minister, Count Rossi, was mortally stabbed by an assassin; nor was any attempt made to punish the guilty perpetrator. Pius' palace was attacked, and the pontiff himself in disguise obliged to flee from Rome in the conveyance of the Bavarian ambassador, Count Spaur, to Gaeta. Here he declared all that had been enacted in Rome since 15th November, 1848, null and void. A republic was established in Rome in the Pope's absence, which continued till the French troops took the city, 3rd July, 1849, after a noble defence on the part of the citizens. The Pope did not return till 12th April, 1850. On the 3rd July, 1848, he announced the completion of a concordat with Russia; in 1851 an advantageous arrangement was entered into with Tuscany; and in the same year a favourable concordat with Spain. An attempt to arrange England into dioceses, with bishops and an archbishop of Westminster, met with a storm of indignation, and led to the passing of an act against it in the English Parliament (Ecclesiastical Titles Act, 5th July, 1851), which proved, however, a dead letter from the first. In 1854 he announced the doctrine of the Immaculate Conception of the Virgin Mary as a tenet of the church from his throne in St. Peter's. The Italian war of 1859 deprived the Pope of two-thirds of his territory, but he made no change in the assertion of his claims. His resistance to all further innovations led to the loss of his mercenary troops at Castelfidardo in 1860, and in the following year the Italian Parliament claimed Rome itself as the metropolis of Italy. The Pope, though solely dependent since 1849 on the support of French troops, refused to enter into negotiations with the Parliament. In 1867 an attack led by Garibaldi was defeated by the papal and French troops at Mentana; but when in 1870 the French troops were finally withdrawn from Rome the Italian army quietly entered, and the temporal power of the papacy came to an end. Though early deprived of a great part of his temporal power, Pius IX. had ever been increasing his influence within the pale of the church. The order of Jesuits had found him willing to aid in carrying out their plans, and they repaid his good will by zealously devoting themselves to his spiritual aggrandizement. The respect due to his personal character, and the sympathies excited by his misfortunes, earned him great veneration among the stricter Catholics of Germany, France, and Spain. By the help of the Jesuits the doctrine of the Immaculate Conception was based on the sole personal authority of the Pope, and to the same source may be traced the Encyclical and Syllabus of 1864, which declared war against freedom of thought in every form, and struck at the very root of modern civilization. In these measures the Pope relied greatly on the counsels of his powerful minister, Cardinal Antonelli. It was believed in 1869 that the time had arrived when the extreme claims of Rome might be stated more definitely and boldly than they had been in any bull since the time of Gregory VII., not excepting *Unum sanctam* and *In cerna Domini*. At the Vatican council held in St. Peter's in that year, the dogma of the Infallibility of the Pope, when speaking *ex cathedra*, was authoritatively declared. Few more important events in church

history have taken place since the sixteenth century. In Germany a new church (the OLD CATHOLICS) was at once formed, composed of those who deny the dogma of papal infallibility. Pius IX. prudently made no use of his newly-confirmed powers. He never accepted the new political order of things in Italy, and chose to regard himself as a prisoner in the Vatican, though as a matter of fact he was as free to go where he chose as any other Italian citizen. The Vatican and a small country estate and villa at Castel Gondolfo, among the hills, suitable for a summer residence, were reserved to him by the Italian government; and within these narrow limits he was considered to reign as a sovereign prince. He took no notice of any of these arrangements, and to the last claimed in full all his ancient rights, and sustained the excommunication which he had pronounced upon Victor Emmanuel and his ministers. His high personal character retained for him the respect of even those who opposed his pretensions, and when he died, 7th February, 1878, he was greatly regretted. He was succeeded by Leo XIII. Pius IX. had reigned thirty-two years, the longest pontificate on record.

PIX. See PXX.

PIZARRO, FRANCISCO, the conqueror of Peru, was born at Truxillo, a city of Estremadura, in Spain, about 1476. He was the illegitimate child of Gonzalo Pizarro, a colonel of infantry who had served with distinction in the Italian wars, and Francisca Gonzales, a person of humble rank. Colonel Pizarro had other legitimate and illegitimate sons, some of whom gained fame in Peru when Francis became illustrious. Of the youth of Francis little is known. His education was wholly neglected; he never learned either to read or write, and to escape from the occupation of a swine-herd he enlisted as a soldier. To that new world so fruitful in marvels and adventures, where Spain was for a season omnipotent, he turned his steps. He had the qualities which command success and vanquish difficulties; for to the most daring valour he joined the most indomitable persistency, and to the promptitude of the soldier the craft of the politician. After being conspicuously associated with many other enterprises, Pizarro accompanied the expedition of the noble, chivalrous, but unfortunate Balboa, when the latter discovered the Pacific Ocean. The conquest of Mexico by Cortes stirred all hearts; it deeply stirred the heart of Pizarro. When Panama rose into importance, many were the aspirations to penetrate the coast to the south, and the Alpine ranges behind. Pizarro entered into an alliance with Almagro, a military officer of great experience; and with Luque, an ecclesiastic. By the help chiefly of Luque, funds were raised, and two small vessels were purchased. In the larger of these Pizarro, at the head of 100 men, set sail in November, 1524. Almagro was to follow in the other. This first voyage, rife in horrible hardships, was resultless except in revealing lands abounding in gold, silver, and precious stones, behind the snowy mountain wall. Early in 1526, by a fresh agreement between Luque, Almagro, and Pizarro, a second voyage was resolved on. It lasted eighteen months or more, and was carried to a triumphant issue only by the heroic constancy of Pizarro. The Spaniards came both into friendly and hostile contact with the natives, and at one or two points marched into the interior. Considerable was the booty of the adventures, though small when compared with their sufferings. But what was of much more importance than booty, was the distinct knowledge which they now obtained of the vast and prosperous Peruvian Empire. To subdue, however, a realm which was manifestly civilized, though in a singular fashion, and which was reported to have immense military resources, could not be the affair of private individuals. Application was first made to the governor of Panama; but he, either from ignorance or jealousy, fiercely discountenanced any fresh undertaking. The three associates determined therefore to appeal to the

crown. Pizarro was chosen as ambassador. He reached Spain in the summer of 1528, and was introduced to the young emperor, Charles V., at Toledo, but it was not until July, 1529, that he received the royal authority to discover and conquer in those regions where he had been a discoverer and a conqueror already, of which, the name of New Castile being conferred on them, he was now appointed governor and captain-general. In January, 1531, Pizarro, having on board three vessels 180 men and twenty-seven horses, started for Panama on the third and final expedition for the subjugation of Peru. Almagro was to follow with reinforcements. Peru had for some time been distracted by civil wars. Two sons of the late inca, or emperor, had contended for the mastery. Atahualpa vanquished his brother Huascar. Though Atahualpa had a high reputation for valour and for military and political skill, he showed both cowardice and incapacity in his dealings with the Spaniards. He heard that they had landed and were crossing the Andes, but made no attempt to stop their march, though in many a defile and on many a rocky height they could have been dashed to pieces. During nearly two years which had elapsed since the expedition began, Pizarro had once or twice received reinforcements; but still he only commanded an insignificant handful of men. On the 15th of November, 1532, he entered the city of Cuzanala, in the immediate neighbourhood of which the huge host of the inca was encamped. He sent messages to the inca, professing the most peaceful intentions. Finally, still breathing peace, he invited him to a banquet. Strangely infatuated, the inca accepted the invitation. Unarmed and accompanied by unarmed men, he came in state to Pizarro's quarters. Evening had scarcely closed, when, with unparalleled and unpardonable perfidy, Pizarro gave the signal for perhaps the most horrible massacre in history. Ten thousand of the defenceless Peruvians are supposed to have been murdered. Pizarro snatched Atahualpa from the general doom, though from no merciful motive. After he had made whatever use of the wretched inca he wished, and had by his means wrung treasure from the remotest parts of the empire, he condemned him to be executed under the pretext that he had engaged in a conspiracy. Successful distributions of the enormous spoil had been made among the conquerors. When Pizarro, however, set foot in Cuzco, the capital of Peru, he and his bloodhounds were disappointed that the streets were not literally paved with gold, and that the sky did not rain jewels, so insane had their covetousness grown. Having nothing further to fear from the Peruvians, he vigorously commenced the consolidation of his government, and the colonization of the extensive and valuable territories which he had brought under the dominion of Spain. In January, 1535, he founded Lima, at first called the City of Kings. As a ruler he displayed much energy and sagacity, and though he was as cruel as any Spaniard, he was seldom wantonly cruel. A rebellion into which Almagro was provoked by his repeated injustice, and by the insolence of his brother, was with some difficulty put down; and Almagro, his old companion in arms, was executed in prison. Risings of the Indians, the turbulence of his own countrymen, troubled Pizarro a little; still he reigned at Lima with tolerable tranquillity, and almost like a king. The former swine-herd was created a marquis, but Pizarro had neither the vanity nor the ostentation of the upstart. On the 26th June, 1541, he was assassinated in his own house by conspirators, adherents of the Almagro faction. At the same time fell his brother Alcantara. Pizarro had a rather imposing presence, natural eloquence, and a winning address.

PIZZICA'TO (Ital., twitched), abbreviated *Pizz*, a musical term, employed to denote that the strings of the violin or violoncello are not to be played with the bow, but twitched with the fingers like a harp or guitar. This mode of playing has a strongly marked individuality of

"colour," and is especially suitable for occasional accompaniment to the voice. The pizzicato of the double-bass is extremely effective, and is in constant use in the orchestra. Nothing replaces its soft, yet intensely penetrating effect.

PLACEN'TA, the vascular structure through which the embryo of mammals is nourished while still in the body of the mother. In the human subject, after impregnation has taken place, a spongy membrane is formed on the inner surface of the uterus by an exudation of lymph. This membrane, called "decidua," lines the whole of the uterus before the descent of the ovum; but when this passes down through the Fallopian tube it gradually pushes the deciduous membrane before it, inverting one portion of it which surrounds the ovum, and is called the "decidua reflexa;" this grows with the ovum till it fills the cavity of the uterus and comes in contact with the other portion, called the "decidua vera," lining the walls of the uterus. The point at which the decidua is reflected upon the ovum is where the placenta is fixed in the uterus. This organ is a spongy vascular mass like a cake, from 6 to 8 inches in diameter, about an inch thick in the middle, and two or three lines at the circumference. It adheres by one surface to the uterus, and by the other is connected with the fetus by means of the umbilical cord. The uterine surface is lobulated, and is connected with the uterus by bloodvessels. The fetal surface is covered by the chorion and amnion, and presents the ramifications of the umbilical vessels, which consist of two arteries and a vein. The radicles of these vessels communicate with each other, but no communication has ever been shown to exist between them and the utero-placental vessels; for if we inject from the umbilical arteries we find that the placenta is rendered turgid, and that vessels are found filled in every part of it, but between their ramifications there will remain an uninjected substance, and the uterine surface will not be injected, for the fetal vessels do not pass all the way to that surface. In like manner, if we inject from the uterine vessels, the placenta will be rendered turgid, but nothing passes into the fetal vessels. From this circumstance it is concluded that the placenta consists uniformly of two portions: the one is furnished by the deciduous coat of the uterus, the other by the vessels of the chorion, and these two portions may, during the first three months, be separated from each other by maceration.

The pure arterial maternal blood is conveyed to the uterine side of the placenta, and the fetal bloodvessels bathed in this arterial fluid take up oxygen from it and part with carbonic acid and other matters. The placental blood thus becomes venous in character, is collected in large sinuses or veins, and so returned to the circulatory system of the mother.

The placenta is found in all mammals save the marsupials and monotremes. In the higher types it is deciduate, and is thrown off complete after birth (the so-called "after-birth"); but in the lower types the fetal part draws out of the maternal part like fingers from a glove, and the latter is gradually absorbed by the mother. Man, apes and

monkeys, insectivores, rodents, and the carnivorous animals are the chief deciduate placental mammals. Pigs, horses, camels, oxen, ruminant and hoofed animals in general (Ungulata), and whales, are some of the chief non-deciduate placental mammals.

PLACEN'TA, in botany, is that part of the ovary on which the ovules originate. See OVARY, OVULE.

PLACODERMI is an order of fishes belonging to the subclass GANOIDEI, established for certain fossil forms from Palaeozoic strata. These are the oldest known vertebrate remains, commencing in the Upper Silurian formations and attaining their maximum in the Devonian; they are of special interest from their abundance in the Old Red Sandstone of Scotland. These fishes are remarkable for the massive armour in which the head and anterior part of the body is encased. The rest of the body was either naked or covered with ganoid scales, and the notochord was persistent.

Pterichthys (fig. 2), which was discovered by Hugh Miller, is one of the strangest of these forms. The whole of the head and anterior part of the body was covered with great bony sculptured plates, covered with dots of enamel, forming a great dorsal buckler, articulated at the sides with a similar large breastplate. The rest of the body was covered with ganoid scales, ending in a heterocercal tail. There was a small dorsal fin placed on the tail, and a pair of small ventral fins were also present. The place of pectoral fins was supplied by two long curved spines covered with finely tuberculated bony plates. These, from their form, could not have been of much use in swimming. Owen suggests that they were employed more like limbs,

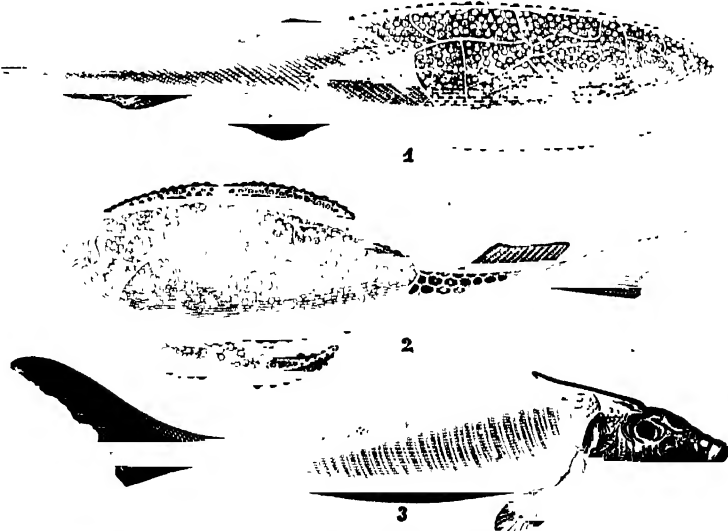


Fig. 1.—*Coccoosteus*, one-third natural size. Fig. 2.—*Pterichthys*, one-fourth natural size.
Fig. 3.—*Cephalaspis*, one-fourth natural size.

enabling the animal to shuffle along the sandy bottom of the sea when stranded at low water. Several species have been distinguished, the best known being named after its discoverer, *Pterichthys Milneri*.

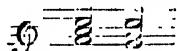
Coccoosteus (fig. 1) is a somewhat similar form, but without the pectoral spines. All the bony plates, which are finely tuberculated, were firmly united, and the tail was long and naked. A dorsal and anal fin were present, the rays of which were well ossified. This genus is chiefly from Devonian rocks, but one species has been found in the Upper Silurian of Bohemia.

Dinichthys is a gigantic fish from the Devonian of North

America, with very similar armature to *Coccoosteus*; in its dentition it resembles very closely *Lepidosiren*, one of the Dipnoi.

Cephalaspis (fig. 3), which is abundant in the Old Red Sandstone, had only a single large shield-shaped plate protecting the head. This shield was produced at the sides, and also in the median dorsal line, into horns. Nearly allied to *Cephalaspis* are *Astrolepis*, which attained a length of between 20 and 30 feet, and had its mouth furnished with two rows of teeth, and *Pteraspis*, which is the most ancient of fishes, commencing in the earlier portion of the Ludlow formation of Upper Silurian age.

PLA'GAL, a musical term signifying athwart, introduced by Gregory the Great. Plagal melodies are those which have their principal notes lying between the Fifth of the key and its octave, the Twelfth of the key. In fact, the plagal scale runs from dominant to dominant of the "authentic" scale. When the subdominant harmony is followed by the tonic, it is called a plagal cadence—



See further the article **AUTHENTIC**.

PLAGIOCLASE (Gr. *plagios*, oblique; *klaos*, I cleave) is the general term applied to all those species of **FELSPAR** which have an oblique cleavage, and belong to the triclinic (or asymmetrical) crystallographical system. The different kinds are known under the names of Albite, Andesine, Anorthite, Labradorite, Microcline, and Oligoclase, but it is convenient to have a comprehensive term, especially for the petrologist, who is scarcely able to distinguish these various types in rocks where the crystals are small. The whole are readily separated from **ORTHOCLEASE**, not only by the cleavage, but also by the usual repeated twinning which causes sections viewed under polarized light to present a number of differently coloured parallel bands.

PLAGUE, a name formerly given to any epidemic disease causing a great mortality, but now limited to one special disease of this kind, known also as the Inguinal, Bubonic, Glandular, Oriental, Levantine, or Indian Plague. Many instances of the occurrence of wide-spreading and destructive pestilences are recorded by historians, and several allusions to their existence and ravages may be found in the Old Testament, but unless we interpret the sixth plague of Egypt (Exod. ix. 8-12) as being the same as the modern disease, the earliest definite reference to it is found in the work of Oribasius, the physician to the Emperor Julian (361-363 A.D.). He quotes from the physician Rufus of Ephesus, who lived during the reign of Trajan, a passage from which it appears that the plague was known as an endemic disease in North Africa, Egypt, and Syria at least as early as the third century B.C. The first trustworthy account of the appearance of the plague in Europe is found in the writings of Procopius, Evagrius, and Gregory of Tours, from which it appears that in the reign of Justinian the disease broke out at Pelusium in Egypt about 542 A.D., from whence it spread to the neighbouring countries of Africa and Asia, passed into Europe, gradually extended its influence over the continent, and ultimately it seems to have reached the whole of the known world. It was everywhere attended by the most frightful mortality, and its ravages affected most materially the subsequent history of the Roman Empire. From this period the disease became established in Europe, and while it was sometimes more and sometimes less prevalent, it was not until 1841 that the last serious outbreak occurred, the seat of this being at Constantinople. Of all the epidemics which have occurred during this period, the most celebrated and the most destructive was that which passed over Europe during the fourteenth century, known as the **BLACK DEATH**, and which has already been described under that head-

ing. The symptoms of this disease, when fully described, appear to justify the conclusion that the Black Death was the true plague in its most severe form, viz., that attended by hæmorrhage from the lungs and from certain of the cavities of the body. It is computed that during the successive waves of this epidemic not less than one-fourth of the population of Europe, or 25,000,000 persons, perished. Numerous outbreaks of the plague occurred in different parts of Europe during the fifteenth and sixteenth centuries, some of them being of extreme severity; and one of the most destructive of all recorded epidemics was that which followed a series of minor outbreaks during the years 1656-66. Beginning in Naples in the first of these years, it is said to have caused the death of 300,000 persons in five months, and during the next few years it passed through Germany to Holland, and in 1664 appeared in London. Beginning with a few isolated cases in the autumn of that year it continued throughout the winter, and in the following summer assumed alarming proportions. During the year the total number of deaths from plague was returned at 68,596, out of a population of 460,000; and it is this epidemic which is generally referred to as the "Great Plague of London." Isolated cases of plague appeared in London during the ten years following this outbreak, and the disease made great ravages in other parts of the country, but soon afterwards it disappeared from England, and it has not since returned. About the same period the plague disappeared, from unknown reasons, from the Netherlands, Switzerland, Western Germany, Italy, and Spain; but the first three decades of the eighteenth century witnessed two serious outbreaks in Europe—the first, in 1703-13, involving Turkey, Hungary, Russia, Poland, Austria, Bohemia, and Eastern Germany; and the second, in 1720-22, in Provence. The pestilence which passed over the latter district was terribly fatal, and in Marseilles the corpses of the victims were left unburied in the streets by thousands, the total number lost in the province being over 87,000, out of a population of some 250,000. During the eighteenth century the plague gradually shrunk away eastward, and during the early part of the present century it became limited to Turkey, from whence it disappeared about 1841. It raged for a few years longer in Asia Minor, Syria, Palestine, and Egypt, and then it seemed to have become extinct altogether. Nine years afterwards, however, it reappeared in Arabia, and there have been sporadic outbreaks of the disease ever since in that country and in Persia, while in 1877 it appeared at Baku on the Caspian, and in 1878-79 Europe was startled by the reappearance of the plague within its limits, by an outbreak which occurred on the banks of the Volga. The latter epidemic happily proved very limited in its extent, and one that passed away very quickly; but that the disease has lost none of its old power when it becomes manifest was shown by the fact that the mortality was at the rate of about 82 per cent. of the cases attacked. During one period of the outbreak all who were attacked died, but at a later period rather more than half recovered.

From the observations made by modern physicians, the symptoms now attending attacks of the plague are essentially the same as those noticed by the earliest medical writers, and they vary according to the three chief forms of the disease recognized, namely, 1, mild, abortive, or larval plague; 2, the ordinary epidemic or severe plague; and 3, fulminant plague.

1. In the first of these forms the disease is characterized by the appearance of swellings in the groins, armpits, neck, or other parts, as a rule painless and unattended by feverishness or other untoward symptoms. Sometimes the swellings suppurate, but more generally they are resolved in about fourteen days (though they may last longer), during which period the patient is generally able to follow his usual avocation. It is not yet known whether this form of the disease

is infectious, but it has been ascertained that in several instances attacks of abortive plague have both preceded and followed the more severe epidemics. Cases of this kind were specially noticed in connection with the outbreak of plague in Mesopotamia in 1873-77, and as preceding the outbreak in Astrakhan in 1878-79.

2. With respect to plague in its usual form, its onset and progress are found to differ much in different cases, and also in different periods of an epidemic. Most commonly the onset of the disease is marked by symptoms resembling those of ague, such as lassitude, pains in the back and limbs, feverishness, mental disturbance rising sometimes into positive delirium or stupor, and by the appearance of buboes in the groins, armpits, or beneath the angle of the jaw. These swellings may occur before the fever, concurrently with it, or from the second to the fourth day of its duration, and they appear in all save the rapidly fatal cases. The fever is usually of an extreme character, being accompanied with headache, intense thirst, and pain in the epigastrium. The face is flushed; the eyes are red or turbid; the tongue swollen, dry, and fissured, sometimes black, but sometimes presenting the appearance of being covered with cotton-wool; the pulse quick, running up to 100-130; while the temperature may be 100° to 107.6° Fahr. As the disease progresses the swelling of the glands increases and is accompanied with acute pain, and in some cases sharp pains, likened to those caused by a stab, are felt in the breast or other regions of the body. If the patient lives on, suppuration of the swellings may take place about the seventh day after their appearance, and a free discharge from them is generally regarded as a favourable sign. In a small proportion of the cases recently observed carbuncles and boils made their appearance in addition to the ordinary buboes, and they were always regarded as an unfavourable sign. Another sign more frequently observed was the appearance of petechiæ or dark blood spots on the skin, either distributed generally over the body or localized in the vicinity of the enlarged glands, varying in size from that of a grain of millet to that of a lentil. They are signs of the worst omen, and are usually followed in a few hours by death. The skin is sometimes so covered with these marks as to give the body a blackened appearance after death, and it was probably this symptom which caused the plague to be known in earlier times as the *black death*. Another notable and fatal symptom of the disease sometimes observed is that in which hæmorrhages from the lungs, stomach, bowels, nose, &c., occur, and where these appear death quickly follows.

3. Fulminant plague is the name given to certain cases observed more particularly at the commencement of plague epidemics, but not confined to this period, in which the patient is struck down suddenly with illness and dies within twenty-four hours without any of the characteristic swellings having made their appearance. These cases seem more like those of poisoning than disease, and they are chiefly marked by vomiting of blood and the setting in of a high febrile state concurrently.

The duration of an attack of plague may vary from a few hours to a month, but the majority of fatal cases end by the fifth day. Many of those who survive the fifth day recover, and the probability of recovery increases with every day afterwards. Rapid suppuration of the swellings indicates a favourable termination, and Surgeon-major Colvil, from his observations of the plague in Mesopotamia, regards the occurrence of diarrhœa as a favourable sign.

With respect to the treatment of the plague, there is no remedy known to medical science which has the slightest power over the disease itself in any of its stages, and curative treatment is at present only possible on general principles both as regards the systemic and the local symptoms.

The origin of the plague is unknown, but in those countries where it is endemic it appears to be caused by a

poison in the soil, which under certain conditions becomes very virulent in its character. In several places, notably in India and China, it has been observed that an outbreak of the plague has been preceded by the death of rats and other animals living in holes in the ground. When the disease has developed it may be transmitted from the sick to the healthy by the air, by contact, and by the agency of clothes, bedding, or other articles which have been used by those affected. The danger from the latter source is not now considered so great as it was formerly, but that the disease may be carried in this way is unquestionable. It is not very clear how far the infection is conveyed by the dead, for while popular tradition, confirmed to some extent by the recent Russian experience, makes the task of burying specially dangerous, the French surgeons who investigated the disease in Egypt during the early part of this century made over a hundred post-mortem examinations without special precautions and without harm. The conditions most favourable to the spread of the plague are insufficient food, the saturation of the soil with putrefying animal or vegetable matters in the vicinity of dwellings, low, badly ventilated, and crowded houses, and generally the existence of a warm and humid state of the atmosphere. In hot countries the disease declines during the hot season and resumes its activity in the winter and spring, while in the colder countries the summer and autumn are the seasons during which the plague exerts its greatest power. This rule, however, is not without its exceptions, for in some outbreaks in northern countries the disease has prevailed as severely in the depth of winter as in the height of summer. In combating the plague attention must be directed to the relief of the impoverished condition of the poor, the prevention of overcrowding, the prompt removal of all decaying animal or vegetable matter from the vicinity of dwellings, and the encouragement of all similar measures in the way of sanitation. Where the malady is present each patient should be isolated as much as possible, and placed where he can be abundantly supplied with fresh air, and all articles of clothing and bedding used should be thoroughly disinfected, or, better still, destroyed. Ships that have left infected ports should be placed in quarantine, and persons who have been exposed to the infection should be isolated for a short time in order to see whether the disease has been taken. Most observers assign eight days as the limit during which incubation of the disease may take place, the minimum period being two or three days, and the mean time five or six.

In the presence of the commercial relations which exist between European countries and the East, the importation of the plague into Europe cannot be pronounced impossible, but there is no reason to fear the destructive epidemics of former days. Bad as are the sanitary surroundings of the poorer classes in the great cities, they will compare very favourably with those which existed in the middle ages: and now that the methods of infection are better understood there would be no fear of the repetition of the overcrowding, &c., which in former times had so much to do with the spread of the disease.

For the most complete medical history of the plague and other epidemics see Hæser's "*Geschichte der epidemischen Krankheiten*" (third edition, Jena, 1882). The anatomical characters of the disease are best studied in the works of Clot-Bey, Bulard, and others of the French surgeons and physicians who investigated the Egyptian epidemic of 1835-36. The results of the latest observations are to be found in the Blue Book on the Plague, published in 1879, and the official reports of Radeliffe, Colvil, and Payne presented to the British government in 1879-80.

PLAICE (*Pleuronectes platessa*) is a well-known species of **FLAT-FISH** (Pleuronectidæ), common on the coasts of Britain and of Northern Europe. The upper side of the body is brown, varying to black, marked with large

orange spots; a row of similar spots are arranged along the dorsal and anal fins; the under surface is white. As in other flat-fish, the body is laterally compressed and unsymmetrical, and both pairs of eyes are placed on the right or upper side. The scales are small and smooth; six bony tubercles are placed in a curved row on the head. Plaice inhabit sandy or muddy banks, occurring in suitable localities in great numbers. In East Friesland they have been introduced into fresh-water ponds, where they are said to thrive. The spawning time is in the early spring, and they are in the best condition for the market in May. The plaice is one of the most important food fishes in England, from the good quality of its flesh and its abundance. It is taken both by lines and by trawl-nets; on the flat sands of the Solway Frith the fishermen capture it by hand. The general weight is 3 lbs., and fish weighing 7 or 8 lbs. are considered large, though specimens have been caught weighing 15 lbs.

PLAID, a striped or variegated cloth worn by the Highlanders of Scotland, forming a prominent part of the national costume, and indicating by the variety of its pattern the different Scottish clans. Plaids worn by the better sort of females are often of silk.

PLAINS, extensive surfaces of land which are level when compared with mountain districts. They compose by far the greater part of the earth's surface. The surface of the ground may be gently waving, as Salisbury Plain and the Ukraine; or more prominently undulated, as the plain around Paris; or it may be studded with hills, as the plains of the Cassiquiare, or intersected with deep ravines, as the central plains of Russia. Plains occur at every variety of height above the sea-level, from the Delta of Egypt and the Llanos of South America, which are but a few feet above the sea, to the plain of Antisana, 13,435 feet above the same level. Though we generally regard those plains which are the least raised above the surface of the ocean as the lowest, it must not be forgotten that round the Caspian and Aral there are plains of many thousand square miles considerably below the sea-level, as is also the case with the plain or valley of the Jordan.

The term *Plateau* is generally applied to elevated surfaces, the average level of which is considerably above the sea-level. A *Table-land*, properly so called, is an elevated plain rising abruptly from the general level of the country, and being, as it were, the broad and horizontal or gently undulating top of an immense mountain, as the Neilgherry district of Hindustan.

Generally speaking, the plains of Europe are of middling elevation, the extremes of high and low being principally found in Asia and America. Thus while the great plains of Central Asia, about Ladak, Tibet, and Katchi, and round Koukounoor and elsewhere, attain a height similar to those of Quito and Titicaca, or from 9000 to 12,000 feet, the great marshy plains of Siberia along the borders of the Frozen Ocean are very slightly raised above the sea-level, as is also the case with the plains of Bengal at the mouths of the Ganges, the whole of Mesopotamia, the Tehama of Arabia, &c. In South America, contrasting with the lofty plains of Quito, of Santa Fé de Bogota, &c., are the llanos and the plains of the Amazon; while in North America the vast prairies in the angle between the Missouri and the Mississippi and the low swamps round New Orleans form a striking contrast with the Rocky Mountains and the elevated plains of Mexico.

Plains differ not only in their elevation, but in their general slope, and in the nature of their soil; and these circumstances, together with their geographical position, influence their climate and productions. The plains of America are generally characterized by their granitic covering or their vast forests; the Asiatic plains by a

twofold appearance, being in some parts studded with low saline plants, and in others, as in Southern Russia, Siberia, and Turkestan, covered with plants of the families of the Compositæ and Leguminosæ; while the greater part of the European plains are highly cultivated.

There are some plains which are remarkable not only for their extent, but for the peculiarities which distinguish them. They are known under the names of deserts, steppes, savannas, prairies, llanos, pampas, and selvas. Deserts have been already described.

Steppes.—This name, which is Russian, is given more particularly to the extensive plains which lie on the north-west of Asia. Considered as a whole, they have a character quite different from the other great plains of the world, though in different parts they present partially the distinguishing features which characterize the llanos, the savannas, the pampas, the sandy deserts, &c. Generally speaking, they consist of rich pastures intermingled with woods, barren sands, and saline clays, and abound in lakes, pools, and streams of salt and bitter waters.

Savannas and Prairies are names given to the great plains that lie chiefly on the western side of the Mississippi, though along the Illinois River they are found to the extent of 1,200,000 acres, and also in other parts of the basin east of the Mississippi. They are divided into three kinds:—(1) the heathy or bushy, which have springs and are covered with small shrubs, grape-vines, &c., very common in Indiana, Illinois, and Missouri; (2) dry or rolling, generally destitute of water and almost of all vegetation but grass; they are the most common and extensive; (3) the alluvial or wet prairies, the smallest division; they are covered with a rich vegetation of tall rank grass; the soil is deep, black, friable, and fertile, and they abound in pools without issue, left by the floodings of the rainy season.

Llanos.—The whole interior of South America, from the mountains of Caracas on the north to the Straits of Magellan on the south, is divided by comparatively low transverse ridges, running east and west into three great basins; that of the Orinoco on the north, that of the Amazon or Marañon in the centre, and that of the La Plata on the south. The first comprises the llanos, vast plains occupying a surface of 260,000 square miles, the chief characteristic of which, says Humboldt, is the absolute want of hills and inequalities, the perfect level of every part of the soil. Often in the space of 270 square miles there is not an eminence of a foot high. This unvarying equality of surface reigns without interruption for 540 miles from east to west, from the mouths of the Orinoco to the Villa de Aurore and Ospinos, and 600 miles from north to south between San Carlos and the Caqueta. There are, however, notwithstanding this uniformity of surface, two kinds of inequalities in the llanos. The first, called *Branco*, are horizontal banks of sandstone or limestone standing four or five feet higher than the rest of the plain, and sometimes many leagues in length. The second kind of inequality, called *Mesa*, consists of convex eminences rising to the height of a few fathoms. The aspect of the llanos is somewhat dissimilar in different places, but the greatest difference depends upon the seasons. In the rainy seasons, says Humboldt, the llanos display a beautiful verdure, but in the time of great drought they assume the aspect of a desert. The grass is then reduced to powder, the earth cracks, the alligators and great serpents remain buried in the dried mud till awakened from their long lethargy by the first showers of spring. These phenomena are observed on barren tracts of 50 or 60 leagues in length where the llanos are not traversed by rivers. The great wealth of the llanos consists in the numerous herds of horned cattle and horses which they feed. The first horned cattle were let loose in these extensive pastures by Christoval Rod-

riñez, about the year 1548, since which time they have increased to almost countless numbers.

Pampas. See PAMPAS.

Selas is a name given to the wooded portions of the great plain of the Amazons. This plain extends over a surface of 2,340,000 square miles, of which about 719,000 are covered with primeval forests, the rest of the space being occupied by waters, and by open patches of a character similar to the llanos and savannas, though little known. This region is one of the most extensive continuous plains in the world.

PLAINS OF ABRAHAM, the name of a table-land immediately south-west of the city of QUEBEC, Canada East, where Generals Wolfe and Montcalm, the respective commanders of the British and French forces, were both killed in action on the 18th September, 1759.

PLAIN-SONG. *Canto Fermo* (or Plain-song) is the Italian name given by the Church of Rome to the ecclesiastical chant, of unknown origin, which some allege was borrowed partly from the music of the Greeks, and partly from that used by the Jews in the Temple. Plain-song is composed of a system of musical accent applied to the syllables of sentences of various length intoned upon a reciting note, a certain number of the syllables concluding each sentence breaking off from the reciting note into a fixed melody. These melodies date in their written form from the eighth century, but are of course much older, being handed down by original tradition. Those who derive them wholly or in part from the Temple services of the Jews, have much to say for their view, but at present the question must be left an open one.

St. Ignatius, a disciple of St. John and other apostles, taught antiphonal chanting, presumably upon plain-song melodies, in Antioch, to the very first Christians ("and the disciples were called Christians first in Antioch," Acts xi. 26), as we know from other sources; and St. Basil, in 363, was inveighed against by his congregation of Neo-Cæsarea when he introduced the Antioch usage there. Nevertheless his friend St. Ambrose, charmed with the effect of the alternate chanting by the two sides of the congregation, founded the similar chant of Milan upon the lines of St. Basil. Early in the fourth century also St. Sylvester founded a singing school at Rome. Thus the collection of plain-song melodies was preserved and gradually grew. It lay, of course, wholly in the ecclesiastical modes [see MODES, ECCLESIASTICAL], each mode having its own special *tone* (melody), and as time went on each *tone* acquiring more than one ending. St. Gregory (Pope in 590) was the first to make a complete collection of the church-songs in his famous Antiphonarium. This was brought to England, at the command of St. Gregory, by St. Augustine, our first Christian missionary, in 596, and soon gained firm footing in this music-loving land. Two hundred years later the Emperor Charles the Great sent for singers direct from Rome to found a correct school of ecclesiastical chant in France. As the centuries rolled on many "uses" or varieties gradually crept in. In England we had the quite distinct uses of York, Sarum, and Hereford. Pope John XXII. (one of the Avignon popes) thundered bulls at these impure musical traditions, in vain seeking to bring all churches to the Roman use. It was one of Wolsey's pet schemes, in the sixteenth century, to suppress all the variations in the English cathedrals, and bring them all to adopt one unchanging form. At the same epoch the Council of Trent was firmly grappling with the problem on the Continent. To those who believed, with Roman tradition, that these melodies were possibly sung by Jesus and his disciples, the maintenance of their exact purity was no mere question of order in the church, but a very vital and sacred duty. In England the question was solved by the breach with Rome, under Henry VIII. Abroad it was solved by the appointment of the world's greatest musician, Pale-

strina, to the task of collecting and arranging the entire system of plain-song, which had then grown to be an immense and most heterogeneous mass. He did not live to finish the work, but left it in such a state that others could carry it on with comparative ease. The famous Plautin copy of the Gradual was produced at Antwerp in 1519, and the still more famous and correct "Medici Gradual" appeared at Rome in 1614. The "Venice Antiphonary," by Liechtenstein, came out in 1580. Copies of these rare works were reproduced at Mechlin in 1848; but as some local "uses" were still to be found in them, Pope Pius IX. ordered a new reprint to be issued. Then arose the now standard works of Ratisbon, by Fustet; the "Ratisbon Gradual" being published in 1871, and the "Vespéral" in 1875.

Turning to England we find attempts by Marbeck and others to adapt the plain-song to the newly-published English Protestant translations and modifications of the ancient Latin service books of the Roman Catholic Church; but eventually the Anglican system of chanting [see CHANT] almost wholly superseded it, except in the scattered churches of the olden faith, and chanting itself fell into disuse among nonconformists. Quite recently chanting has become generally popular, and in the Church of England advantage was taken of this to reintroduce the plain-song, or *Gregorian* chant. Dye's "Book of Common Prayer, noted," appeared in 1843; Oakeley's "Laudes Diurnæ" followed it, providing for the psalms and canticles; and these were succeeded by the deservedly popular works of the Rev. Thos. Helmore, "The Psalter and Canticles," and "The Directory of Plain Song," in 1850, and the "Hymnal, noted," in 1851. Owing chiefly to these later works, and to the foundation of the Gregorian Church Choir Association, many Protestant churches, especially those belonging to the High Church party, now habitually use these ancient melodies.

The principal plain-song melodies are the *Tones*, often called *Gregorian Tones*, though probably St. Gregory had nothing to do with them beyond collecting their best versions. These are nine in number, one to each of the principal eight modes (four authentic and four plagal), and a ninth one called *Tonus Peregrinus*. [See TONES, GREGORIAN.] The psalms, &c., are sung to these *tones* according to a recognized rotation, and each psalm is accompanied by an *antiphon* in the same mode. This is a passage selected from Scripture as appropriate to introduce (and also on festivals to follow) the psalm; its melody is freer than that of the *tone* proper, and is also unquestionably of later date. Other plain-song melodies are allotted to the *Versicles* and *Responses* of the Mass, to the Kyrie, Gloria, Credo, Benedictus, &c. More elaborate plain-song compositions are those used for Introits, for Graduals, for the Communion, for the Offertorium, and for the long sequences, or "proses," of which the "Dies Iræ" and the "Stabat Mater" are the most familiar examples. Finally, there are a large number of hymns (Palestrina's "Hymns for the Whole Year," 1589, is a collection of wonderful beauty), many of which have become favourites with Protestants by means of the highly popular "Hymns, Ancient and Modern." Proske's "Musica Divina" is another storehouse for these and other plain-song melodies.

Connected closely with plain-song are the ecclesiastical accents, short musical phrases used by the priests when chanting in monotone the lessons and other passages of scripture appointed to be read in the services, and serving to mark stops, quotations, dialogues, &c. See ACCENT.

PLANARIÆ is an order of the class PLATYELMINTHA or flat worms. The Planarians are lowly organized, non-parasitic worms, found both in fresh and salt waters, and on land. The body is oval or leaf-shaped, with a soft skin covered with cilia, by means of which the aquatic forms swim. The fresh-water forms are generally minute,

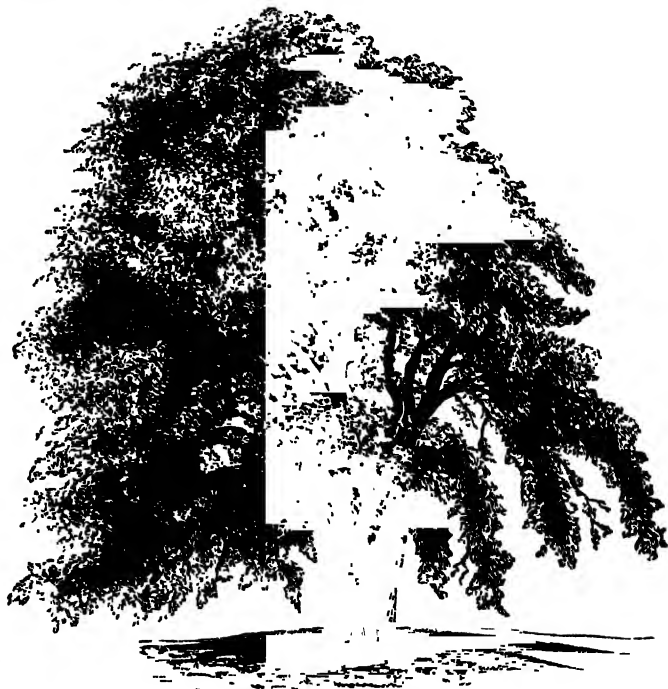
some being scarcely larger than large infusorians. An anus is always absent, and the mouth, which serves both for the reception of food and the rejection of the undigested portion, is sometimes situated in the middle of the ventral surface, or even close to the posterior extremity. In some of the aquatic forms the alimentary canal is totally obliterated, the food, after passing into the mouth, sinking into a solid mass of cells. A glutinous secretion is produced by the epidermic cells, which serve to fasten the animal on to surrounding objects, and these cells also contain peculiar rod-like bodies, which are thought to have a tactile function, and, sometimes "nematocysts" or stinging threads, similar to those found in jelly-fish. There is no circulatory or respiratory system, and the nervous system is of a simple character. Eye-spots, sometimes in great number, are present on the anterior extremity of the body. There are excretory organs in the form of long coiled tubes, opening by either one, two, or more apertures. Reproduction is sexual, and with few exceptions the sexes are united in the same individual.

The planarians are divided into three suborders. The Rhabdocela are small, free-swimming forms, found in the sea and also in fresh-water ponds, and feeding on worms, insect larvæ, &c. Some (Convolutidæ) are remarkable for containing in their tissues chlorophyll, the colouring principle so characteristic of green plants. A few multiply asexually by transverse fission. The Rhabdocela have either a straight unbranched alimentary canal or none at all. The suborder Polyclades contains all marine forms with a thin leaf-like body, and a much-branched intestine opening into a central stomach. In some cases the young pass through a metamorphosis before attaining maturity. In the suborder Triclares the alimentary canal has three main branches, and there is no central stomach. To this suborder belong the largest known forms, both terrestrial and marine. The land forms are specially tropical, though two are European species. They have an elongated leech-like body, and live under leaves, feeding on snails, worms, and insects.

PLAN'CUS, a distinguished Roman family of the Manutian gens or clan. By the favourite quotation *Consule Planco* ("in the consulship of Planco"), taken from Horace's "Ode to the Romans" (Carm. iii. 14), and used as equivalent to "in the days of youthful strength," reference is made by the poet to Lucius Manutius Planco, the friend of the great C. Julius Cæsar, and governor of Gaul at the time of his murder. He joined at first with Antony, but on discord arising between the triumvirs, he attached himself to Octavianus, the nephew of Cæsar, B.C. 32, and it was on his proposal that the title of Augustus was conferred upon the latter, B.C. 27. Horace, when he cries, "When Planco was consul, in my hot youth, I would not have borne this," is referring to his own tribuneship as a young man under Brutus (on the opposite side to Planco and the triumvirs) in the year of the battle of Philippi, B.C. 42, Planco being consul, according to arrangements made by Cæsar before his assassination.

PLANE (*Platanus*) is the sole genus of the order of plants **PLATANACEÆ**. There are five or six species, natives of the temperate region of the northern hemisphere.

They are lofty trees with dense foliage and massive trunks, the bark of which annually scales off in large irregular patches. They have alternate, deciduous, palmate leaves, provided with stipules. The flowers are monoecious, collected in globose stalked catkins; the male flowers consist of four sepals and four stamens alternating with them; the female of four sepals, four barren stamens, and from four to eight carpels. The ovary is one-celled, and contains one or two pendulous ovules. The Oriental Plane (*Platanus orientalis*) is a native of Asia Minor and the Levant. It appears to acquire a very great age, was extensively employed by both the Greeks and the Romans for avenues and other purposes of ornament, and is to the present day the handsomest of all the hardy deciduous trees in cultivation. In the East it attains a height of 70 feet and upwards. It is frequently planted in this country for shade and ornament, and succeeds best on a light deep moist soil in sheltered situations. It may be propagated by seeds, layers, or cuttings. Its timber is fine-grained, hard, and well suited to such kinds of joiners' work as do not require strength, for which its brittleness renders it ill suited.



The Oriental Plane (*Platanus orientalis*).

The American or Western Plane (*Platanus occidentalis*), a native of the United States, is also a tree of very large size and of considerable beauty, although inferior to the Oriental. This is the species found in Hyde Park, and in other public places near London, and is that usually planted in England, from being more readily propagated, though it is less suited to our climate. The wood is seldom well ripened, and is therefore liable to injury in winter, and it is continually damaged by our spring frosts, the consequence of which is that the trees grow slowly, and have always a shabby appearance, few of their leaves being free from brown and dead portions, unless in very favourable seasons. It grows more rapidly than the Oriental plane, and has broader and less deeply cut leaves and larger fruits. The wood is not much esteemed. The tree is sometimes

called Button Wood, from the resemblance of the smooth round catkins to globular buttons, and Cotton Tree, from the down which is detached during the summer from the under side of the young leaves.

The name Plane is often given in Scotland to the Sycamore (*Acer Pseudo-platanus*), from the resemblance of its foliage to that of the planes.

PLANE, a well-known carpenter's tool, derives its name from its power to *plane* (Lat. *planare*) or level-down a given surface by cutting. In essence a plane is simply a machine for holding a chisel at a certain convenient bevel or slant, and for guarding its edge so that it shall not cut beyond a certain limited depth. It is evident that a steel chisel-shaped tool, set in a long block of wood, from which it protrudes slightly, will be able only to pare off a fine shaving when the block is driven over a surface, and that it will exercise a selective power, cutting down the highest parts and passing the lowest parts of the surface, until this latter comes to be as level as the under surface of the block or plane itself.

Planes are of many sizes and varieties, according to their work. The usual size is the "jack-plane" [see JACK], and from this we increase up to the long "trying-plane," whose great length and fine cut insure an accurate surface, or decrease to the "smoothing plane" or the small "thumb-plane." But these are all flat-surface planes. A quite distinct variety is that of the planes with curved faces, planing "rounds" or "hollows," or striking entire mouldings, composed of various curves. In each case the shape of the "plane-iron" follows that of the under surface of the plane. The "rabbet-plane" is a thin plane which works upon a portion of the surface only, reducing this (or "rabbeting" it) beneath the general level, so that a groove or ledge is made along the edge. The rabbet-plane is provided with a "fence" to guide its range of action. If the groove is in the midst of the surface and not at the edge the variety is called a "plough," the principle of working being essentially the same.

PLANING MACHINERY. Of late years machinery has been applied to the preparation of the surfaces of wood, of stone, and of iron. The wood-planing machines consist of cutters, or steel plates, working with a rotary motion. The precision and rapidity with which these machines work have given great facilities for building, as one machine will do as much as fifty men. In planing machinery there is a large bed or plate along which the beam or plank is moved, each part coming in turn under the operation of the revolving cutters; or the bed, for large timber or for metal, is connected with the driving power in such a manner as to allow the bed to move in a horizontal direction forwards against the cutter, carrying with it the material to be planed. The tool or chisel is held in a fixed position in iron-planing, pressing downwards upon the moving metal plate. By this action a groove is ploughed into the iron, and the process is repeated as often as required, until the whole surface is reduced to the desired level. The stone-planing machine is similar in construction and working.

PLANE FIGURES are such as lie wholly within (or upon) one plane. The chief are the circle; the triangle; the square, rectangle, rhombus, and parallelograms generally; the pentagon, hexagon, octagon, and regular polygons generally.

PLANE GEOMETRY, that branch of GEOMETRY which confines itself to the consideration of plane surfaces, and of the figures and lines, whether straight or curved, which can be drawn upon them.

PLANE, INCLINED, one of the so-called elementary mechanical powers. See INCLINED PLANE.

PLANE SURFACE or **PLANE** is a term of the highest importance in geometry. It expresses a surface which is the same shape all over and on both sides, or it

may be otherwise regarded as a surface which divides space into two congruent regions, or regions which (so far as regards the plane where they touch) are of precisely the same shape. A body may have several varieties of surfaces. Supposing it has, among others, two plane surfaces (e.g. two neighbouring surfaces of a cube, which has six plane surfaces), then the common edge or intersection of these two plane surfaces is a straight line. The plane is to surfaces what the straight line is to lines.

It must also be borne in mind that a plane is purely an abstraction. The geometrical notion of surface has extension only, but no thickness. The surface of a marble table, if accurately ground, may be a plane, that is to say, the contact-surface of the air and the table is a plane. The plane is neither a layer of air nor a layer of marble, but that extension of surface, entirely devoid of thickness, which lies between the two, its under side being the top of the table, and its upper side the air which is in contact with the table.

PLANETARIUM. See ORRERY.

PLAN'ETOIDS. See ASTEROIDS.

PLANETS. We refer to the articles SOLAR SYSTEM, GRAVITATION, MERCURY, VENUS, EARTH, MARS, JUPITER, SATURN, URANUS, NEPTUNE, for an account of the general features of the great planets of our system, as well as for the laws of the movements by which the planets are governed. In the present article we propose to describe the minor planets of our system which have not been included in the scope of the articles referred to. According to the indications of the law of Titius, there seemed to be a great gap between the orbits of Mars and of Jupiter. Except for this gap the law seemed tolerably complete, but it seemed to require that some planet should be found at a distance equal to about double that of Mars. The presumption that some planet really existed in that region was so great that in the year 1800 an association of astronomers was formed with the view of systematically searching the zodiac for its discovery. But it curiously happened that before the search had commenced the expected planet was discovered. On 1st January, 1801, Piazzi, at Palermo, discovered a star in the constellation Taurus which had not been seen there previously. Observing it again the next night he found that its place had changed, and that it was in fact a planet. Piazzi followed the planet for about six weeks, until it was lost in the approach of the sun. No other astronomer had seen the object, and it became a difficult problem to discover the planet again when it emerged from the vicinity of the sun. Gauss, the celebrated mathematician, grappled with the problem. He showed that when three or four observations of the position of a planet had been received, the orbit of the planet became determined, and the planet could be traced through all its subsequent wanderings. He applied his method to the observations of Piazzi, and he deduced the place of the planet with such accuracy that it was quickly rediscovered. The planet was named Ceres, and it was found to revolve, as was expected, in an orbit between Mars and Jupiter, at a distance a little less than double that of Mars. This discovery was followed by that made by Olbers in March, 1802, of another planet revolving also between Mars and Jupiter, to which he gave the name of Pallas. A third planet, Juno, was found by Harding in 1804, and a fourth, Vesta, by Olbers himself in 1807. A pause in the discovery of small planets then ensued. It was not until thirty-eight years after the discovery of Vesta that Hencke (December, 1845) found a fifth planet, and then the discoveries followed with rapidly accelerating speed, until at the present moment (1886) considerably more than 200 have been discovered. The search for minor planets is a work now carried on in several observatories. For this purpose maps have been prepared on which the stars are recorded with great accuracy and minuteness.

These maps need not extend to the whole surface of the heavens, as the planets are generally found in or near the ecliptic, and therefore it is only the regions in or near the ecliptic which require to be mapped. The astronomer compares the stars which he sees through his telescope with the stars which he sees recorded on the map. If he detects an object in the heavens not represented on the map, then the question arises as to what the object may be. If it be very small, it may possibly be a star which has escaped the attention of the astronomer by whose observations the map has been constructed. It may even be a star which by reason of variability in its brightness was not noticed when the map was made, but which has become conspicuous when the comparison of the map with the heavens has been made subsequently. The first test to apply to an object of this kind is to ascertain whether its position is constant or whether it has a movement relatively to the stars. The observations of an hour will decide this point, and if the object be certainly not a comet, then we may conclude it to be a planet. Before announcing a discovery, it will be necessary for the astronomer to see that his planet is not one which has been previously observed. For this he must refer to an Ephemeris, which contains predictions of the places of all the planets. Such an Ephemeris, on a most elaborate scale, is to be found in the successive volumes of the *Berliner Jahrbuch*. Here will be found the position of each planet at intervals of twenty days throughout the year, while the place is given for each day in the neighbourhood of opposition.

All the planets in this group are remarkable for their minuteness. It is believed that their diameter ranges from 200 or 300 miles for the largest, down to perhaps 20 miles or even less. It would certainly take several thousand of these small planets to form a globe as massive as the earth. Many of them are likewise distinguished by the great inclinations of their orbits. That of Pallas is $34^{\circ} 43' 28.1''$, while there are ten with inclinations exceeding 24 degrees. Their eccentricities are also in many cases very remarkable, that of Polyhymnia is the sine of $19^{\circ} 51' 10''$, and there are at least a dozen more nearly as large. Taking the mean distance of the sun from the earth as unity, the mean distance of No. 149 Medusa is 2.132, and of No. 153 Hilda is 3.944; between these lie the distances of the other planets from No. 1 to No. 211.

PLANETS, in heraldry and astrology. The seven colours of heraldry were held to be connected with the seven planets, all that were known in the middle ages. The arms of royal personages are always blazoned by the names of planets, not of colours. The order is as follows:—Sun, *gold*; Moon, *silver*; Saturn, *black*; Jupiter, *blue*; Mars, *red*; Venus, *green*; Mercury, *purple*.

The planets ruled astrologically the days of the week in this order:—Sunday, the Sun ☉; Monday, the Moon ☾; Tuesday, Mars ♂; Wednesday, Mercury ☿; Thursday, Jupiter ♃; Friday, Venus ♀; Saturday, Saturn ♄. The names of the days in the Latin languages preserve this—e.g. French: Dimanche ("Lord's day"), Lundi, Mardi, Mercredi, Jeudi, Vendredi (Ital. Venerdì), Samedi.

PLANT. See **PHYSIOLOGY**.

PLANTAGENET, a name often given to the Angevin kings of England, originating from Geoffrey the Handsome, count of Anjou, who used to wear a sprig of the common broom of Anjou (*Planta genista*) in his helmet as his cognizance. Geoffrey married Maud (Matilda), daughter and heiress of Henry I. of England. The first of the race in England was Geoffrey's son, Henry II.; the last reigning male descendant was Richard III. (1154–1485). By the marriage of Henry VII. with Elizabeth, eldest daughter of Edward IV., and heiress of the Plantagenets, their claims were fused in those of the new Tudor dynasty.

PLANTAGINÆE is a small order of plants belonging to the group **GAMOPETALÆE**. They are herbs, usually without stems, and with large ribbed radical leaves. The flowers are usually hermaphrodite, and arranged in spikes. The calyx is four-parted and persistent; the corolla membranous, persistent, with a four-parted limb; the stamens are four, alternate with the segments of the corolla; the ovary is free, two to four-celled, with a simple style; the fruit is a membranous capsule with a lid. There are over 100 species, chiefly found in temperate and cool regions, disposed in three genera, of which *Plantago*, which contains the **PLANTAIN**, is the chief.

PLANTAIN (*Plantago*) is the typical genus of the order of plants **PLANTAGINÆE**. The Greater Plantain (*Plantago major*) is one of the most common of British plants, and has been called Way-bread, from its prevalence on the wayside. This plant has a peculiar tendency to grow in the neighbourhood of the abodes of men, and although not intentionally conveyed, it has accompanied our colonists to every part of the world, being known in some of our settlements to the natives under the name of the "Englishman's foot." It is a perennial, with broad, strongly-ribbed ovate leaves, from the centre of which rise several long cylindrical spikes of greenish flowers. The spikes, when ripe, are largely gathered to feed canaries and other cage birds, which are very fond of the seeds. The Hoary Plantain (*Plantago media*), a very similar plant, is found in meadows and pastures in England, where it does great injury by being pressed so closely to the ground as to smother other plants. The leaves and root have been used in decoction as an astringent lotion. The Ribwort or Rib-grass (*Plantago lanceolata*), abundant in meadows and pastures in Britain, was once cultivated as an agricultural plant, but was found to be unprofitable, and has ceased to be sown. It has narrow leaves and short brown spikes, borne on long stalks; the seeds are given to cage birds. *Plantago Coronopus* (buck's-horn plantain), another British species, is found in gravelly and sandy places, both near the sea and inland. It has been eaten as a salad, but is too bitter and astringent to be palatable, and from these properties it is sometimes used, as is the greater plantain, to cure wounds and ulcers. It is distinguished by its pinnate toothed leaves, which radiate so as to resemble a star, whence it is sometimes called Star of the Earth. A fifth species, *Plantago maritima*, is found on the sea-coast and on mountains in Great Britain. There are numerous foreign species.

The name Plantain is also given to the **BANANA** (*Musa paradisica*). See also **MUSA**.

PLAN'TAIN-EATER (*Musophaga*) is a genus of birds belonging to the order **SCANSORES** and family **Musophagidæ**. The *Musophagidæ* are large and beautiful birds, entirely confined to tropical and South Africa. They have a strong, thick convex bill, with finely serrated edges near the tip. They have much the appearance of game birds, and have frequently a beautiful crest on the head, which they can raise or depress at will.

The Violet Plantain-eater (*Musophaga violacea*) is about 20 inches in length. It has a large bill, the base of which forms a broad plate, extending far up on the forehead. The general colour of the plumage is a deep violet, tinged with blue on the upper parts, and dark green on the breast and belly. The back of the head is deep crimson, and a curved white streak runs beneath each eye. The primaries are of a violet crimson colour, and the bill is orange yellow at the base, gradually deepening in tint till it becomes red. This beautiful bird frequents the banks of the rivers of Western Africa, feeding upon the fruits of the plantain.

The **TOUTRACORS** (*Corythæ*) belong to the same family.

PLANTÉ BATTERIES, or *Secondary batteries*, provide a means of storing electricity by a voltmeter, or

series of voltmeters, the opposite surfaces of whose plates are charged respectively with hydrogen and oxygen, so that at will a current can be set up. What is done is in effect to produce a chemical effect by electrical means, and then to reproduce an electrical effect by permitting the deferred chemical combination at last to take place. See BATTERY ELECTRIC.

PLANTIGRADE is a term applied to those mammals which apply the whole sole of the foot to the ground in walking, as the bears, and do not walk on their toes, like the cats, which are termed digitigrade.

PLANTIN, CHRISTOPHE, a celebrated printer, was born in a village near Tours in 1514, of poor parents. He learned the trade of bookbinding at Caen, and moved to Antwerp in 1549, where for a time he pursued his avocation, but having sustained an injury to one of his arms he abandoned bookbinding for printing. The earliest book known to have proceeded from his press is "*La Institutione di una fanciulla nata nobilmente*," published in 1555, and the work which has given him most celebrity is the great "*Biblia Polyglotta*" in eight vols. folio, which issued between the years 1569 and 1572. The publication of the latter work was opposed by many of the clergy, but Philip II. of Spain sent his court chaplain, the learned Benedictus Arias Montanus, to undertake the editorship, and contributed 6000 crowns towards the expenses. Plantin, though inferior to his contemporaries Aldus and Estienne (Stephen) in scholarship, surpassed them in enterprise and business capacity. In 1575 his printing office reckoned more than twenty presses and seventy-three workmen, besides a similar number who worked for the office at home, while the beauty and correctness of the works which issued from his establishment brought him both fame and profit. In addition to his office at Antwerp he established branches at Paris and Leyden, but the chief establishment was that of Antwerp. He died 1st July, 1589, and his three printing establishments were subsequently conducted by his sons-in-law. The mark of the works issued by Plantin and his successors is a hand holding a pair of outstretched compasses, the motto being "*Labore et Constantia*."

The old mansion which had been the home and printing office of Plantin from about 1580 until his death, and which was afterwards used by his successors, was acquired in 1876 by the city of Antwerp, together with its collection of about 2000 MSS., 10,000 wood engravings, an equal number of books, and a valuable collection of typographical curiosities, for a sum of 1,200,000 francs. It was opened to the public in 1877, and it now constitutes one of the most remarkable museums in the world.

PLANTING and PLANTATIONS. Planting is the operation of placing in the soil the roots of a plant which has been previously removed, and the preservation of the root is the first thing to be attended to. It should be kept in mind that the *spongioles*, or delicate extremities of the fibres, are the parts by which the chief supply of food from the earth is absorbed by the plant. Their tissue being tender and almost naked, they are very susceptible of injuries from mechanical action; and being adapted for performing their functions in a humid medium, they readily suffer from being kept for any length of time exposed to free air and drought. In taking up the plants, therefore, the roots should be loosened in such a manner as to receive the least possible violence in the operation. If the tree be large, a trench should be opened beyond the extremities of the roots, of sufficient width and depth to allow the process of undermining to be freely carried on. The roots should be gradually set at liberty by a round-pronged fork, the prongs tapering so as to be easily inserted, yet not by any means so sharp as to prick the roots. As the fork is being used, the soil from among the roots will fall into the open trench, but as it accumulates there it must be

cleared away, and at the same time the portion of roots set at liberty will require to be slightly tied together with pieces of matting, and if necessary supported by temporary stakes, or held on one side by an assistant, whilst the planter proceeds in liberating others. If there be, as is frequently the case, a tap-root extending to a much greater depth than the other roots, and if the latter have been carefully preserved during the operation, the tap-root may be cut off, for it could only be raised in a mutilated state, owing to the great solidity of the earth at such a depth. Although it is very desirable to preserve the greatest possible quantity of sound roots, yet all that are bruised or lacerated should be cleanly amputated up to the sound parts.

In the early stage of rearing trees, while the proportion of roots predominates, it may be found advisable in various cases to shorten, not only the tap-root, but also judiciously some of the other strong roots, in order that subdivisions of a more fibrous nature may be produced, and a number of rootlets substituted for large root-branches. The roots, by this kind of management, and by being kept from exposure to drying winds, frost, and wet, will suffer little from the operation of removal; but if the operation be not performed at the proper season, success will not be complete. Though December, January, and February are sufficiently moist, yet November, or as soon as the leaves have fallen, is the preferable season for planting. There may be some exceptions, as in the case of very wet soils, where the plants, if not firmly rooted, are liable to be thrown out during winter, owing to which spring planting would be more proper. But under ordinary circumstances all deciduous trees will succeed best if planted at this period. Such species as push forth their buds early ought certainly to be planted in autumn. Many of the Coniferous tribe will succeed well if planted soon after they have made their summer's growth: the earth is then warm, and the plants make roots very promptly.

The watering of newly-planted trees should be attended to. The supply in the first instance should be copious, in order to wash the earth into the cavities among the roots; but afterwards no more water should be artificially applied than is necessary to moisten the roots as much as the soil in which the species grows naturally, and at a time when shoots and leaves are abundantly produced. In the case of plants being much dried from long carriage or other causes, the supply on first planting should be very moderate. The tops, however, should be frequently syringed, in order to moisten the bark and allow the sap to descend towards the root.

The manner of performing the operation of planting may be reduced to one general principle, that of placing the roots in the soil so as to imitate as closely as possible the position which they occupy when growing naturally.

The excavation for the reception of the roots of a plant should be considerably larger than those roots will traverse when extended at the time of planting. It should be as wide at bottom as at top. The bottom should be more or less convex, and the depth such as to admit of the roots being covered to the extent observed in undisturbed seedling plants of the same species; that is to say, the upper part of the root should only be just covered. The lower roots should be regularly disposed over the convex bottom of the excavation, and carefully strewed with some of the finer portion of soil, over which the other roots may be spread. More soil should then be carefully rather than forcibly introduced. A plentiful watering should be given when the soil is nearly all filled in; and after the water has subsided, so as not to stand above the surface, the latter should be covered with the rest of the soil.

Plantations are generally planted thick in the first instance, and with various species of trees. Larch, Scotch fir or pine, mountain ash, &c., are interspersed among the

hard wood for shelter, or as nurseries. *Laburnum* is also useful for preserving the other sorts from the depredations of barks, as they prefer the *laburnum* to every other bark. The nurse-trees are generally left till they are fit for various purposes for which small timber is applicable. They should be planted closer to each other than to the principal trees intended to constitute the more permanent part of the plantation.

After all the care of the planter and the skill with which the operation of removal may have been effected, much of the success of a plantation depends on the proper adaptation of species to the soils and situations most suitable to them.

Too close planting produces weak drawn-up timber, in consequence of the tops only receiving a due share of light. If, on the contrary, trees are planted at too great a distance from each other, they are inclined to ramify into large limbs and spreading tops, with a stem short but much thicker than where the space admits of less expansion of foliage. If therefore very thick timber of no great length be required, wide planting is proper; but if tall timber be the object, the plantation must be moderately thick.

The care which plantations require from year to year consists in making up deficiencies, thinning, and pruning. Deficiencies seldom occur if the planting be at first properly performed. Thinning should be commenced in due time. No branch of the temporary trees should by any means overhang the top or even branches of those that are permanent. The shelter on the most exposed sides should be formed of robust, vigorous, growing kinds, and it should be allowed to remain unbroken. Plantations that have been neglected till they have formed a dense thicket must be thinned gradually; for if thinned at once, those left would be injured by the sudden exposure, and would be blown over by winds.

The proper season for felling trees is when the sap is most at rest. The operation ought not to be performed at any other time, unless for fire-wood. The sap contains the elements of fermentation, the powerful effects of which are evident even on the strong fibre of the oak. Softer woods, although very tough if cut at the proper season, have been observed to crumble almost to powder in a year or two, in consequence of having been cut when in sap.

PLANT-LICE. See *APHIDÆ*.

PLANTS, FOSSIL. See *PALÆONTOLOGY*.

PLANUDÈS, a learned monk of Constantinople, serving under the Palæologoi as ambassador to Venice (1327) and in similar offices of state, is noteworthy as the compiler, or rather the abridger, of the famous collection of epigrams, epitaphs, and elegiac pieces of Greek poetry known as the "Greek Anthology." His version is that still chiefly used, though the discovery by Salmasius of the Vatican Codex, at Heidelberg in 1606, showed that Planudès was not, as was till then believed, responsible for the whole, but had done little more than abridge that collection. The Vatican Anthology is by a monk of the tenth century whose name alone is known, Constantine Kephala, and is called the "Vatican" because it was removed to the Vatican library in 1623, and only restored to Heidelberg in 1815. Jacobs's edition of the Anthology and copious commentaries (thirteen vols., Leipzig, 1795-1814) is the best. The same author also edited the text of the Vatican (Heidelberg) Anthology in three vols. (Leipzig, 1817).

PLASMA, the liquid part of the blood. See *BLOOD*.

PLAS'SY (Fr. *Palasé*, from *palas*, the red flower of the *Butea frondosa*), a village on the Bhagirathi River, in the district of Nadiyá, Bengal, 96 miles north of Calcutta. It is celebrated as the scene of the famous victory gained by Colonel (Lord) Clive at the head of about 1000 Europeans and 2000 Sepoys over the Nawab Siraj-ud-Daula, 23rd June, 1757. [See *INDIA*.] It is this victory which is generally taken by historians as the beginning of the British

Empire in the East. Of the actual battlefield nothing now remains, as the Bhagirathi, on whose left or east bank the battle was fought, has eaten away the scone of the strife; just as the Jalangi River, in the same district, has eaten away the city of Nadiyá, the ancient capital of Bengal. As early as 1801 the river had washed away most of the battlefield, and a traveller recorded in that year that "a few miserable huts, literally overhanging the water, are the only remains of the celebrated Plassy." Some 8000 of the mango trees, under the shelter of which Clive kept his men, were still left at this period, but the neighbourhood afterwards relapsed into jungle, and now only one solitary tree remains, which is held sacred by the Mohammedans. The highroad from Calcutta *viâ* Krishnagar to Berhampur passes close by the field.

PLASTER-OF-PARIS. When gypsum is heated to a temperature of from 110° to 120° C. it loses the whole of its combined water and becomes a comparatively soft porous mass. This, when ground to a fine powder, is known in commerce as *plaster-of-Paris*, the large gypsum quarries in the neighbourhood of the French capital being worked on an extensive scale for its production. The plaster rapidly combines with water, evolves some heat, and soon solidifies; it is thus largely used for making casts and moulds, and for producing a hard finish on walls. It is also employed in the glazing of porcelain and in the manufacture of artificial marble. According to a passage in Theophrastus, this useful material appears to have been well known to the ancients, and extensively employed both for architectural decoration and the making of images.

PLASTERS, in medicine, are chiefly composed of unctuous substances united to metallic oxides, or to powders, wax, or resin. They are used in the form of external applications, which possess sufficient consistence not to adhere to the fingers when cold, but which become soft and adhesive at the ordinary temperature of the human body. The materials employed are usually made up in the form of rolls, which are kept wrapped in paper, and when required for use a little is melted off the roll by means of a heated iron spatula, and spread upon leather, linen, and silk. The less adhesive plasters, when spread, are usually surrounded with a margin of resin plaster to cause them to adhere.

There are many kinds of plasters (or "emplastra," as they are termed in the British Pharmacopœia) used in medical practice, and the work just named contains formulas for making about a dozen. They are chiefly employed to act mechanically by affording support to weak muscular structures, to protect sores and abraded parts, and to keep the surfaces of wounds in contact; but a few which contain acrid, stimulating, or narcotic substances, and operate as rubefacients, blisters, or anodynes, are still retained in practice. The common "diachylon" or lead plaster is made by boiling together powdered litharge, olive oil, and water, and by spreading the mass when it has a proper consistence upon calico. When properly made it is very adhesive and smooth, and is quite free from irritating properties. Lead plaster, combined with resin and a little hard soap, forms the common adhesive or "sticking" plaster, which is so largely used to protect raw surfaces, for dressing ulcers, and retaining the lips of recent cuts and wounds in contact. It possesses gently stimulating properties, which are often of value in assisting a healing process, but which render it unsuitable for all cases where irritation must be avoided. "Soap" plaster differs from the latter in the proportions of lead and resin, and in containing a larger amount of soap.

PLASTIC CLAY, in geology, an old term for that series of the Eocene strata more generally known as the *WOOLWICH AND READING BEDS*. The name alludes to the frequent interstratification of stiff clays, valuable for pottery manufacture, which are largely worked in the

neighbourhood of Paris, and to a certain extent also in the London basin.

PLA'TA, RIO DE LA (the "River of Silver"), an immense inlet into which flow the great rivers Parana and Uruguay, having at its mouth a width of above 170 miles, and extending 40 miles above Buenos Ayres, a total distance of about 270 miles. It is only of moderate depth, but the yellow pampean mud brought to it by the rivers, and drifted out by the strong south-west Pampero winds to which it is subject, is discernible in the Atlantic for 150 miles beyond its mouth. The inlet is all but tideless, changing its level only a foot or two according as the winds are blowing out or in, to or from, the Atlantic. It receives the drainage of an area exceeding 1,250,000 square miles, from a distance to the sources of Paraguay of 2450 miles. The north shores are high and rocky, the south low and flat; the depth at Monte Video is only 3 fathoms, towards its mouth 10 fathoms. Vessels drawing more than 16 feet water cannot ascend above Buenos Ayres.

PLATA, LA. A century after the discovery of the above river by Solis, in 1512, the conquest of the southern region of South America by the Spaniards may be said to have been achieved; and in 1620 all the country south of the confluence of the Paraguay and the Parana rivers was separated as the "Government of the Rio de la Plata," and made the seat of a bishopric by the Pope, with Buenos Ayres for its capital. In 1788 a vicerealty, with its capital at Buenos Ayres, was formed out of the provinces of Rio de la Plata, Paraguay, Uruguay, and Bolivia. In 1806-7 Buenos Ayres and Monte Video were for a short time in British possession. Soon afterwards struggles for independence began, and in 1810 the viceroy was deposed and a "junta gubernativa" appointed. Political independence of Spain was achieved in 1816, and the provinces of La Plata were united in a confederation. The present constitution of these provinces, now known as the Argentine Republic, dates from 1853, after which Buenos Ayres declared itself independent. In 1860 Buenos Ayres rejoined the confederation, and its chief town became the capital of the republic. See ARGENTINE CONFEDERATION.

PLATEA. See PLATAIAL.

PLATAI'AI (Lat. *Plataea*, sometimes, but incorrectly *Platea*), an ancient Greek city, in Boiotia (Beotia), close to Attica, and at the foot of Mount Kithairon (Cithæron). The origin of its plural name, as of that of Athens and many other Greek cities whose names are of plural form, is now lost. It may be the relic of a forgotten distinction akin to that of the patricians and plebeians of Rome, or of a prehistoric union between dwellers in the fortress and their vassals in the plain, as if one should say "the united Plataias," "the united Athenas," &c. Plataiai was never a large place, but it was always of great importance from its position and its hereditary leaning towards Athens. It thus became a thorn in the side of Boiotia. The Plataians fought with the Athenians at Marathon, in the first Persian invasion (B.C. 490), and as a reward had their city burnt by Xerxes in the second (B.C. 480); but their revenge was splendid, for it was under their ruined walls that the great victory was achieved (479) which drove the Persians for ever from Europe, and saved us (until the coming of the barbarous Turks) from Oriental tyranny. As a reward and a commemoration alike, the territory and city were decreed sacred and inviolable by an unanimous oath of all Greece. It prospered greatly under this protection until the secular hatred of the Boiotians led them to induce the Spartans to attack it (as a lover of Athens) in 429, during the Peloponnesian War. The heroic resistance of the Plataians to the great southern warlike state, which lasted two years, is one of the most stirring episodes in the history of Greece. It was completely demolished by the Spartans in 427, was rebuilt forty years later, and again

razed to the ground by the Thebans in 374. It was restored for the third time, about forty years later, by the great kings of Macedon, and enjoyed considerable prosperity thenceforward, through the Greek, Roman, and Byzantine empires.

PLATANA'CEÆ is an order of plants belonging to the group MONOCHLAMYDÆÆ, containing only a single genus, *Platanus*. See PLANE.

PLATANIS'TA is a remarkable genus of CÉTACEA, forming with the genus *INIA*, the family Platanistidæ, or river dolphins. The *Susu* or Dolphin of the Ganges (*Platanista gangetica*), like the *inia* of the Amazon, is entirely confined to fresh waters, being found in the rivers Ganges and Indus throughout their course, and in their various tributaries. It is from 6 to 12 feet in length, and has a long body, sooty black in colour, with a very small dorsal fin placed far back. The flippers are short, broad, and triangular in shape. The snout is long and narrow, swollen at its extremity from enlargement of the jaws. The teeth are numerous and simple in character, those at the end of the jaws being more conical and pointed than those further back. The eyes are so minute as to be probably quite functionless. The blowhole is a longitudinal slit.

The *susu* keeps to the deep water, occasionally coming to the surface to breathe. It feeds on small fishes and shrimps. It is one of the oldest known of the cetaceans, having been originally described by Pliny, and is invested with a semi-religious character by the Hindus.

PLATE, the name given to gold and silver made into articles of household use—more especially plates, dishes, knives and forks, and spoons. In order to prevent fraud, assay offices are established in different parts of the country [see HALL MARKS], and anyone selling any article previous to its being assayed and marked, is liable to a penalty of £50. The inland revenue duty on gold plate is 7s. 6d. per oz., and 1s. 6d. on silver; but gold watch-cases and rings, and silver watch-cases, chains, tipplings, mountings, collars, bottle tickets, teaspoons, &c., are exempted. The customs duty on imported gold plate is 17s. per oz., and 1s. 6d. on silver. The counterfeiting or transference from one piece of plate to another of the marks, stamps, &c., impressed on them, is a felony punishable by penal servitude and imprisonment. Manufacturers of gold and silver plate pay a license of £2 6s. per annum if they only make articles weighing from 2 dwt. to 2 oz. of gold and above 5 dwt. and under 30 oz. of silver, and £5 15s. if the manufacture is above those amounts. Pawnbrokers in gold and silver pay the same amounts. Under the 33 and 34 Vict. c. 32, no license is necessary for the sale of watch-cases by the maker.

PLATE-POWDER, the name given to various kinds of composition used for cleaning and polishing gold and silver plate. One description is made by reducing quicksilver, mixed with twelve times its weight of prepared chalk, to an impalpable powder. It puts a remarkable brilliancy on silver-plate, but affects most injuriously its durability, the mercury eroding the surface, and causing the metal to become soft, and in extreme cases even brittle. The only powder that may be safely used for silver is finely levigated or precipitated chalk. For gold, the red oxide of iron, known as jewellers' rouge, is the most useful and appropriate. The powders should be applied by means of a plate brush, chamois leather, or very soft woollen rags, and the application should be gentle and long continued rather than the reverse. Dirty plate, after being cleaned with boiling water, may be restored by boiling it in water, to each quart of which a few grains of carbonate of soda, and about an ounce of prepared chalk, calcined hartshorn, or cuttle-fish bone, in very fine powder, has been added. The ebullition sets up a gentle friction, which has an excellent polishing effect, and the process

may be completed by a gentle rubbing with a piece of soft leather which has been dipped into the cold mixture of chalk and water, and then dried.

PLATING is the art of covering or coating one metal or alloy with another. It is one that is extensively practised in metal working. It was originally applied to the production of imitation gold and silver plate, whence its name, but since the introduction of electro-plating [see **ELECTRO-METALLURGY**] many other metals and alloys which possess advantages of beauty, durability, &c., over those which they cover, are employed in this way. The old method followed in the preparation of imitation silver-plate consisted in soldering to one or both sides of an ingot of the baser metal a thin plate of silver. The ingot was most carefully prepared on the surfaces designed to receive the silver, and the plates of the latter metal, after being coated with a solution of borax, were firmly wired to it, the whole being then placed in a muffle furnace, and subjected to a strong heat. The furnace was so arranged that the metal could be continuously watched, and the moment the soldering was complete the ingot was withdrawn from it. The compound ingot was then rolled to the requisite thickness between cylinders of polished steel, the common thickness of the silver-plate after rolling being about the one-fortieth of the compound ingot. However thin the plate might be made, it was always found that the relative thickness between the ingot and its layers of silver remained the same. This method, known in the trade as Sheffield-plating, from the large extent to which it was carried on in that town, is now almost extinct, being superseded by electro-plating. The gilding of metals is a process analogous to plating, the only distinction being found in the thickness of the deposit.

Another kind of plating very extensively practised is that of covering iron with brass, most of the stair-rods, curtain and picture-rods, &c., used in upholstery being prepared in this way. Lead pipes used for conveying water are sometimes plated inside with tin, and nickel has recently come into use for plating the interiors of iron cooking vessels.

PLATINUM. This important rare metal was first discovered in the auriferous sand of some of the American rivers. The name is derived from the Spanish word *plata*, or silver, given to it on account of its whiteness. It is found in small grains, having a metallic lustre. The largest piece of native platinum yet discovered is in the Denidoff Cabinet at St. Petersburg. It weighs 78 kilos. or over 17 lbs. The principal localities are Brazil, Mexico, California, St. Domingo, and the Ural Mountains. The metallic grains contain 75 to 85 per cent. of platinum, associated with palladium, rhodium, osmium, iridium, and ruthenium. The ore is digested with nitro-hydrochloric acid, which leaves the osmium and iridium undissolved; the platinum is precipitated from the solution by chloride of potassium. The precipitate is dried and ignited with potassium carbonate, which reduces the platinum to the metallic state; this is redissolved in nitro-hydrochloric acid, and again precipitated by ammonium chloride. The double chloride of platinum and ammonium so obtained is ignited, when the platinum is left behind in a spongy mass, known as spongy platinum. This can be hammered or welded into plates, or fused in a lime crucible in the oxyhydrogen furnace. It usually contains traces of iridium, which increases its tenacity and hardness, and improves it for most of its applications.

Pure platinum is nearly as white as silver, and takes a high polish. It is soft, ductile, and malleable. It is not a good conductor either of heat or electricity. It can only be fused in the oxyhydrogen furnace, or by electricity. The temperature of fusion is given by Deville at 2000° C. (3632° Fahr.) With the exception of osmium and iridium, it is the heaviest of all the metals, and it is also the

least expansible by heat. The specific gravity of platinum is 21.5. It can be drawn into wire not exceeding the two-thousandth part of an inch in diameter, and can be beaten into very thin leaves. It does not alter by exposure to air even when highly heated. It is also very tenacious: a wire only one-fifteenth of an inch in diameter will sustain a weight of 274 lbs. It is easily welded, and is much used in the laboratory, in some important manufactures, and in the construction of chemical apparatus. Large platinum stills, some weighing over 1000 ounces, are used for the concentration of oil of vitriol. The symbol is Pt. The atomic weight is 197.4. It is less easily attacked by chemical reagents, and is better adapted for these purposes when it is alloyed with iridium and rhodium. It was employed for coinage in Russia from 1826 to 1844, and platinum to the value of 2,500,000 dollars was then coined in the Russian mint. The metal contained 2 per cent. of iridium. Its use as a coin has been given up. When precipitated from solution as a black powder, known as platinum black, it has a remarkable power of causing the combination of oxygen and hydrogen, by condensing these gases on its surface. It oxidizes alcohol into acetic acid, and wood spirit into formic acid. Spongy platinum exhibits the same peculiarity to a lesser extent, and even platinum wire becomes red hot in mixtures of oxygen and hydrogen, and in vapour of spirit. A small perfume vaporizer is sold which is founded on this principle. It is a small spirit lamp containing the perfume, surmounted by a coil of fine platinum wire; it is first ignited and then blown out, when the wire continues to glow at a red heat until all the spirit is vaporized. Platinum is not attacked by any mineral acid, but a mixture of nitric and hydrochloric acids dissolves it slowly. It is much employed in the laboratory for crucibles, but caustic alkalis or alkaline earths cannot be fused in these, as the metal is corroded. Metals must not be fused in platinum crucibles, as it forms fluid alloys with many of these. Platinum forms a yellow alloy with copper, which takes a good polish, and is sometimes employed for the mirrors of telescopes. With equal parts of gold it forms a very malleable alloy resembling gold.

Platinum forms two series of compounds, diatomic or platinoous, and tetratomic or platinic compounds.

There are two chlorides—the dichloride or platinoous chloride (PtCl_2), and the tetrachloride or platinic chloride (PtCl_4). *Platinoous chloride* is a brown powder insoluble in water, but soluble in hydrochloric acid. It combines with metallic chlorides, forming double salts called chloroplatinates; that of potassium is obtained in red prisms, having the formula K_2PtCl_6 .

Platinic chloride is a brownish red powder, soluble in water, and giving off chlorine when heated, metallic platinum being left. It is useful in analysis for the precipitation of potassium and ammonium, which are precipitated from solution as double salts, known as chloroplatinates. The potassium salt crystallizes in yellow octahedrons, quite insoluble in alcohol, and having the formula H_2PtCl_6 ; the chloroplatinate of sodium is soluble in alcohol, hence platinoic chloride is employed for the separation of these two bases, ammoniacal salts having been previously removed by ignition. Only one bromide of platinum is known, the tetrabromide (PtBr_4), a brown deliquescent substance; it also forms double salts known as bromoplatinates, that of potassium having the formula K_2PtBr_6 .

Fluoride of platinum (PtF_4) is a yellow powder, soluble in water. It also forms double salts with the alkaline fluorides. There are two iodides of platinum—platinoous iodide (PtI_2) and platinoic iodide (PtI_4); both are black amorphous compounds. The latter forms double salts with alkaline iodides, called iodoplatinates; that of potassium is a black crystal, having the formula K_2PtI_6 .

Carbide of platinum is a black insoluble compound.

Nitride of platinum (Pt_3N_2) decomposes at 190°C . (374°Fahr.), giving off nitrogen gas.

There are two oxides of platinum—platinous oxide (PtO) and platonic oxide (PtO_2). *Platinous oxide*, as obtained by precipitation, is a hydrate (PtOH_2O) which, when fully heated, gives the anhydrous oxide. It is soluble in the caustic alkalis, forming salts called platinites.

Platonic oxide.—The hydrate is brown, which when heated leaves the oxide as a brown powder; it is soluble in acids, forming the platonic salts, but it also combines with alkalis and alkaline earths to form salts called platinates. Platiniate of sodium has the formula $\text{Na}_2\text{O}3\text{PtO}_2\cdot6\text{H}_2\text{O}$. Platinum silicide (PtSi_2) is a white crystalline compound. Two sulphides are known, platinous sulphide (PtS) and platonic sulphide (PtS_2); both are black insoluble substances, but the latter dissolves in alkalis, forming salts called sulphoplatinates.

Platinum salts combine with ammonia, and form an extensive series of ammonio-platinum salts; similar compounds are formed with methylamine and ethylamine, and choline. Some of these salts are bodies of great complexity. Platinum is detected in solution by the precipitate with potassium chloride, the ease with which it can be reduced to the metallic state, and its great infusibility and resistance to mineral acids.

PLATO (Gr. *plátōn*, the broad one), the most celebrated philosopher of antiquity, was born at Athens, or, by some accounts, in the neighbouring island of *Ægina*, in 429 B.C., the year in which the great Athenian statesman Periklēs died. His lineage was ancient and illustrious, ascending on his father's side to Kodros, and on his mother's to Solon. His original name, Aristoklēs, was changed into Plato (Gr. *plátos*, broad) either on account of the breadth of his forehead, or as some say of his chest, or the comprehensiveness of his genius. Fable threw her marvels around his infancy. While his father and mother were sacrificing to the Nymphs and Graces on Mount Hymettus, and their child was sleeping in a bower of myrtles, a swarm of bees is said to have alighted harmlessly on his lips—an ingenious fancy suggested, we may suppose, by the murmuring sweetness of his style. His youth and early manhood were coincident with his country's decline. The unfortunate expedition of the Athenians against Sicily took place in 415 B.C., and Athens never recovered her position as the head of the Greek states after this misdirected enterprise. Its disastrous effects, combined with the unpromising issue of the Peloponnesian War, seems to have given Plato a strong distaste for public life, to the highest offices of which his rank and talents might have entitled him to aspire. He saw his country now reaping the fruits sown by the rule of an unbridled democracy and the self-seeking morality of the Sophists; and turning away from political strife he devoted himself to philosophy, and to the construction of that ideal city which is not made by the private passions of men, but "is founded in reason, although it exists nowhere on the earth" ("Republic").

At the age of twenty Plato made the acquaintance of Sokrates, an event too remarkable not to be embellished by marvellous accompaniments. Sokrates dreamt that a young swan came flying towards him from an altar in the groves of Akadēmos, and after resting on his bosom soared up into the clouds, pouring forth strains which ravished the souls both of gods and men. The next day Plato was introduced to him, when he immediately recognized in him the young swan of his dream. Thus did fiction, with a fine feeling of the truth, seek to give expression to the wonderful affinity which drew together these two gifted natures; for never were two minds connected by closer intellectual and moral sympathies. Each gave completion and symmetry to the other: without the magical influence

of Sokrates, Plato might have lived in vain; and without the penetrating insight of Plato, Sokrates might have come down to us as the excellent and sensible, but rather commonplace moral preceptor depicted in the "Memorabilia" of Xenophon. His profounder lessons would not have found their way to posterity. We have nothing professedly of Plato's own. He adopts the dramatic form; and speaks as a mere reporter of Sokrates, professing only to record the dialogues of that great talker, held with whoever cared to try conclusions with him. Nevertheless, and in spite of almost every opinion he advances being elsewhere contradicted (by the necessity of the dramatic form he adopted) in his writings, it is not altogether impossible to gather the personal views of Plato, especially with the help of the alternative account of Sokrates by Xenophon, in which, of course, there is nothing of Plato.

Plato passed about ten years in close companionship with Sokrates. In 399 B.C. his great master had to drink the fatal cup. Plato desired to defend him at his trial; and indeed began a speech which the violence of the judges at once cut short. On the death of Sokrates, it was dangerous and useless to remain at Athens, so his disciples dispersed. Plato sought refuge at Megara, a town situated about 25 miles from Athens. Here he was hospitably entertained by his friend Enkleidēs, who had also been a disciple of Sokrates, and who had founded a philosophical school at this place. This is not the famous geometrical familiar to us as Euclid, who lived a century later. It is probable that Plato composed several of his "Dialogues" at Megara. How long he remained there is uncertain. The general account of his middle life is that during the ten years subsequent to the death of Sokrates, he visited Egypt and Cyrene (*Kurēnē*), where he studied geometry under the celebrated mathematician Theodōros; that he travelled into Southern Italy, attracted thither by the fame of the Pythagorean philosophy; and that he spent some time at the court of the Sicilian tyrant Dionusios. His moral and political counsels are said to have so much offended this despot's pride, that he shipped off Plato to be sold as a slave in the market at *Ægina*. He was bought by a Cyrenaic philosopher, Annikeris, who gave him his liberty, and generously restored him to Athens. Plato was about forty years of age when he returned to his native city. For all this period tradition is the only authority. Nothing certain is known. He established a philosophical school in the groves of Akadēmos, the name of the Athenian to whom the ground formerly belonged, and who had presented it to the public for a gymnasium. Here he lived, and wrote, and lectured during a period of more than forty years, interrupted only, as the ancients believed, by two short visits to Sicily. What again drew him thither after the bad treatment he had received, was probably the hope of being permitted by the younger Dionusios to attempt the realization of his ideal republic in the city of Syracuse. If so his hopes were disappointed. Modern scholars are disposed to reckon these Sicilian journeys as entirely mythical. Plato died at Athens in the eighty-second year of his age, 347 B.C., and was succeeded in the Akadēmia by his nephew, Speusippos. The most famous pupil of Plato was Aristotles. As to his appearance, Plato was most majestic and venerable. His grand forehead and massive frame dispute the honour of his surname (Gr. *plátōn*, the broad one). He was never known to laugh, but a smile was not unfrequent with him. He was so melancholy that "as sad as Plato" passed into a proverb. His tall frame stooped somewhat, and his brow was furrowed, with the lines ploughed deep by perpetual thought. Among his crowds of reverent admirers he had hardly one friend. "His soul was like a star and dwelt apart." But the wit and humour of his dialogues show that his melancholy and separateness were not due to gloom nor misanthropy: when he chooses no one has a lighter, gayer touch. Professedly a hater of

poets, passages of the truest poetical feeling abound with him. He was so great a man that to our smaller minds he is often a paradox of contrasts, inexhaustible, delightful, stimulating.

The philosophy of Plato is usually and conveniently divided into Dialectic (or metaphysics), Physics, and Ethics. Dialectic is his peculiar contribution to science. In ethics he followed out the principles of Sokrates; in physics he borrowed much from the older cosmogonies; but in dialectic he is eminently original, although here too the Sokratic influences are discernible. Dialectic is the science of ideas. What, then, are ideas? These will be best understood if we first state the opinion which the theory of ideas was designed to correct or supplement; for it may be assumed as a general rule in philosophy, that every new doctrine has for its object the correction either of some antecedent scientific error, or of some natural oversight incident to ordinary thinking; from which it follows that to understand a new doctrine we must first understand the old opinion to which it is opposed. In this case the old opinion was the system known as "sensationalism," which resolves all thought and knowledge into sensation. The purport of the Platonic theory, on the other hand, is that, in the constitution of knowledge, sensation, so far from being the whole, is, in truth, but a part, and that not the highest. Ideas, not sensations, are the light of our knowledge. The use of the word *idea* is here seen to be somewhat different from the modern connotation.

The subject both of Platonic ideas, and of the term *idea* as used in other senses, is elsewhere treated of. [See *IDEA*.] In this place it is sufficient to note that all general conceptions, such as man, animal, tree, are ideas; they are also called universals, to distinguish them from the particulars which are included under them. According to the modern doctrine, the mind commences with a knowledge of particulars and then proceeds, by a method of abstraction and generalization (which consists in attending to agreements and leaving out of view differences), to fabricate general conceptions or ideas. According to Plato, the first stage of knowledge is, not the apprehension of particulars, but the apprehension of ideas or universals, and the application of these to particulars. There is an actual abstract *man* as well as the concrete and individual John, Thomas, Charles, &c., and the latter can only be known by apprehension of the former. This apprehension is possible, because of the immortality of the soul, which has been conscious of the pure *ideas* in its previous state, before birth, and so recognizes things from their likeness to the heavenly ideas. This solution makes knowledge to originate in ideas, and not ideas to have their origin in knowledge. The Platonic theory may be summed up by saying, that the mind thinks and knows by means of genera and species. They are the essential conditions of all thought, all knowledge, and all existence. It is impossible for a thing either to exist, or to be known, except as an instance of some genus or species. Genera and species—in other words, ideas—are thus, according to Plato, the most objective, the most independent, the most real, and the most enduring of all things, inasmuch as they are the necessary laws or principles on which all-being and all-knowing are dependent. Such is the realism of Plato. From a casual remark of Aristotle, we happen, in this case, to know that we have here a Platonic, and not a Sokratic doctrine. "Sokrates gave neither to general terms nor to definitions a distinct existence" (Aristotle's "Metaphysics," xiii. 4); so that at least in this department—one, too, which runs through all his work—Plato distinctly deviated from his master.

The physics of Plato may be passed over as presenting few points of interest or intelligibility. His ethics have a stronger claim on our attention. Plato's moral philosophy will be best understood by being confronted with that of

the Sophists, against which it was specially directed, just as his theory of ideas was designed to refute their theory of knowledge. If man be nothing but an aggregate of sensations, he can have no other end than sensational enjoyment, and no other principle of action than selfishness. Such was the general purport of the Sophistical morality. In opposition to this, Plato, in his "Republic," has drawn a parallel between the soul of man and the political constitution of a state. Just as a state cannot exist unless it is sustained by political justice, that is to say, unless the rightful rulers rule, and are aided by the military, and unless the inferior orders obey; so the individual soul does not truly and healthfully exist, unless it is the embodiment of private or personal justice, that is to say, unless reason rules the lower appetites, and is aided in its government by the more heroic passions of our nature. A character which wears the mask without having the substance of virtue, is no better, indeed is worse off, than a sick body which presents the mere appearance of health. Such is the scope (in so far as a few sentences can give it) of the moral philosophy of Plato in its more popular aspect, as presented to us in the "Republic." He treats the subject more metaphysically in the "Philebos," but the result reached is in both cases the same. The maintenance of that organization of the soul in which reason rules and passion obeys—this is the end to be aimed at by man, rather than happiness or pleasure.

Plato's views of good and evil are very noble. The good is the perfect; now everything has its contrary, and necessarily there must be evil, which is the imperfect. But where is evil to be found? Not in heaven, amidst the pure ideas or abstract existences; clearly upon the earth, amidst the imperfect phenomena which, according to him, represent those pure celestial ideas. It is no wonder, then, that the evil in this world, and here only, exceeds the good in quantity, nor that it should always be in conflict with the good. Life, Plato perceived and taught, is made up of this struggle. Man has free will and intelligence; it is for him to choose; and according to his choice so will his future life, the life after death, be regulated. Plato here becomes almost Pythagorean in his view of successive existences, depending each one upon the conduct held in the one preceding. Again, to those who doubted the existence of God, Plato replied that God was proved to exist by the very feeling of affinity to his nature which stirred within men's souls. From these most cursory remarks it may be gathered how suggestive and how lofty are the wonderful philosophical dramas of Plato, and how many of the problems of to-day are placed before the mind with the brilliant clearness of Greek thought in his pages.

More important than any results, either moral or metaphysical, which have been brought to maturity by Plato, are the inexhaustible germs of latent wealth which his writings contain. Every time his pages are turned, they throw forth new seeds of wisdom, new scintillations of thought—so teeming is the fertility, so irrepressible the fulness, of his genius. All philosophy, speculative and practical, has been foreshadowed by his prophetic intelligence; often dimly, but always so attractively as to whet the curiosity of those who have chosen him for their guide.

Bekker's edition of the Greek (Berlin, 1816) still remains among the best. Plato has had two recent English interpreters of the highest rank, the earlier of whom is the historian Grote ("Plato and the Companions of Sokrates," 1865), and the second, Professor Jowett, afterwards master of Balliol College, Oxford. The translation of Professor Jowett (1871) is possibly the best translation of any ancient work that has yet appeared. It is absolutely perfect, and reads with all the interest and graceful ease of an original. Each dialogue is prefaced by an exhaustive commentary and paraphrase. It is not too much to say that Plato, in this splendid translation, is made accessible to the ordinary non-

classical Englishman in such fulness and accuracy as is shared by no others of the great philosophers of antiquity. The inexpressible charm of the original reappears in a marvellous manner: and if Plato had been an Englishman it seems as if these would have been his words. Instead, therefore, of lengthening this article, it is better to refer the reader to this fascinating book, that he may converse with Plato himself.

PLATTSBURG, a town of New York, in the United States, situated near the mouth of the Saranac in Lake Champlain, 150 miles north of Albany, with several churches, a court-house, custom-house, barracks, lyceum, woollen, cotton, and leather manufactories, saw and flour mills, and a large trade. The population in 1880 was 8283. It was here that the British were defeated by the Americans in 1814.

PLATYELMIN'THA is one of the great classes into which the heterogeneous subkingdom VERMES is divided. The members of this class are generally called flat-worms, from the usual flattened character of the body. They are all low forms, many being internal parasites. They are usually hermaphrodite, with complex generative organs. Organs of circulation and respiration are frequently absent, and the nervous system is of a low type. Four great groups are included in this class, the two last being parasitic—*PLANARIE* and *NEMERTINÆ*, sometimes united into one order, *Turbellaria*; *TREMATODA*, containing the flukes; and *Cestoidæ*, containing the TAPE-WORMS.

PLATYPUS. See *DUCKBILL*.

PLAUTUS, TITUS MÆCCIUS, the Latin poet (up till recently called, quite erroneously, by moderns *Marcus Accius Plautus*), was born at Sarsina, a village in Umbria, about 254 B.C. He seems to have come to Rome at an early age, and lived there for some years in humble circumstances. About the age of thirty he is supposed to have entered on his dramatic career, shortly before the commencement of the second Punic War. He continued to write for the stage during forty years with great popular success, as many as 130 plays being attributed to him in the later days of the republic. He died 184 B.C. His reputation as a poet continued to flourish in succeeding generations. Happily we are enabled to judge for ourselves of his merits, twenty of his best and most genuine comedies having come down to us. The plots and materials of his plays, Plautus, like his countryman Terence after him, borrowed from the Greek, mostly from the Athenian poets of the new comedy, especially Philemon, Diphilos, and Menandros. But as none of the Greek originals are extant, it is impossible to ascertain with any precision how much he borrowed from them—how much was created by his own genius. The "*Aulularia*," the "*Captivi*," the "*Miles Gloriosus*," and the "*Trinummus*," are among the most interesting of his plays. Several of the comedies have been imitated by modern writers, as the "*Menæchmi*," by Shakespeare in the "*Comedy of Errors*;" the "*Mostellaria*," by Addison in the "*Drummer*;" the "*Aulularia*," by Molière in "*L'Avare*," and the "*Amphitruo*," in "*Amphitryon*;" the "*Trinummus*," by Lessing in his "*Schatz*;" while the "*Pænulus*" is interesting as containing almost the only specimens known to exist of the ancient Punic language. Plautus appears to have shown marvellous skill in adapting Greek scenes and persons to Roman characters. The Greeks in his plays speak, act, and jest exactly as we may suppose the Romans to have done, and there occurs scarce anything in his dramas which can have been foreign to the Romans. The scenes are laid at Athens, Epidamnus, or Ephesus, and the names of the persons are Greek, but we are reminded every moment that we are in the very heart of Rome. The parasite is, however, an exception, being a Greek and not a Roman character. His language is no less admirable than his poetical skill—being copious, powerful, and refined—a clear proof that the Latin tongue

had been successfully cultivated by previous writers. Plautus is especially valuable to us on two grounds besides his intrinsic merits:—(1) As the only literary monument of his age which has descended to us in anything more than a fragmentary condition; (2) as the best exponent we have of ancient Roman customs and manners. Although there are many useful editions of separate plays of Plautus, a good edition of his entire works is still a desideratum in scholarship. Bothe (Leipzig, 1884) gives the best complete edition; but as far as it goes, the unfinished edition of Ritschl (two vols., Bonn, 1850) is by far the finest. It contains (1) the *Trinummus*, *Miles Gloriosus*, *Baccidæ*; (2) *Stichus*, *Pseudolus*, *Menæchmi*. Ritschl's "*Parerga*" on the author (Bonn, 1845) are also very good. At Cambridge Professor Wagner produced a scholarly edition of the "*Aulularia*" in 1866, and Professor Ramsay of the "*Mostellaria*" in 1869.

PLEADINGS, in law, are the allegations of the respective parties to a cause expressed in technical language. In order that a decision may be made by a court, it is necessary that the points to be decided should be clearly ascertained, and this is sought to be effected by the system of pleading, by which the points in controversy should be presented for decision unencumbered by extraneous matter.

Under the proceedings in vogue previous to 1875, the practice of the various courts was exceedingly diverse, both as regarded the commencement of actions and the subsequent pleadings. Some actions were commenced by writ, some by bill, and some by plaint, while the pleadings were generally either so refined as to be embarrassing, or so loose as to be useless. The Judicature Act simplified matters in both respects. Every action must now be commenced by Writ of Summons, indorsed with a statement of the nature of the claim made, or the relief or remedy required, and must specify the division of the High Court to which it is to be assigned. Full provision is made for the summary disposal of the class of cases in which no substantial defence or resistance may be offered, while as regards pleadings, the Act follows up the great improvements which had been commenced by the Common Law Procedure Act of 1852. The practice is now regulated by the rules of the Supreme Court, 1883. By Ord. xix. r. 4, "every pleading shall contain, and contain only, a statement in a summary form of the material facts on which the party pleading relies for his claim or defence, as the case may be, but not the evidence by which they are to be proved, and shall, when necessary, be divided into paragraphs, numbered consecutively. Dates, sums, and numbers shall be expressed in figures, and not in words. Signature of counsel shall not be necessary; but where pleadings have been settled by counsel or a special pleader, they shall be signed by the solicitor or by the party if he sues or defends in person."

Previous to 1883 the plaintiff had in almost every case to deliver a "statement of claim," but now no statement of claim is delivered where the action is commenced by a specially indorsed writ, or where the writ is not specially indorsed, unless the defendant gives notice in writing that he requires a statement of claim to be delivered. In reply to the writ or "statement of claim," the defendant presents a "statement of defence," which is met in turn by a "reply." This, if not a mere joinder of issue, may be followed by a rejoinder, surrejoinder, rebutter, and sur-rebutter in succession, but no pleading other than a joinder of issue can be pleaded after reply except by leave of the court or a judge. If a plaintiff make default in delivering his statement of claim where it is due within the time allowed, the defendant may move to dismiss the action for want of prosecution; and if a defendant make default in delivering his defence, the plaintiff may, in certain cases, enter judgment against him as if he admitted the claim.

The ancient modes of pleading in Scotland appear to

have been borrowed from those of France—the leading object of which was to separate the law from the fact, so that the judge might decide the law of the case in the first instance, without having his mind distracted by questions of disputed facts. For this purpose the facts were assumed as stated by the parties, and the law as applicable to them ascertained. When this had been accomplished, if any issue of fact remained doubtful, proof was allowed, and to the facts so established the law already ascertained was applied. This method, suitable enough so long as lawsuits were few and simple, proved inconvenient and sometimes impracticable when the subject matter of litigation became involved and intricate, and the practice was gradually introduced of allowing the parties to go into their evidence before judgment. This mode of procedure was styled a proof before answer. Both methods are still available, according to the nature of the case. Prior to 1825 the Scotch pleaders had fallen into a system of wide, and what might be called vituperative pleading, in which, without much regard to accuracy of statement, they endeavoured by material statements to enlist the sympathy of the court in favour of their respective sides. This abuse became so great that the legislature interfered and introduced the “closed record,” in which the claim was stated in a simple writ of summons, and each party stated his case on separate papers—the plaintiff in his consignment, and the defendant in his defence. These respective pleadings were not to contain anything but simple averments of matter of fact, and attached to each what was termed “pleas in law,” setting forth in short propositions the legal arguments on which each intended to rely. These pleadings were thus to be adjusted so as exactly to meet each other; and the record, so adjusted, was to form the basis of all the subsequent proceedings of the case. This mode of pleading has now been long in operation in the Scottish tribunals, and though from time to time it has been varied and improved to meet the requirements of the day, it now may be said to form the type of pleading in all Scottish courts of record. It has given general satisfaction, combining brevity with clearness, trenchantly separating the issues of law and fact from each other, sufficiently rigid to exclude irrelevancy, and yet sufficiently elastic to meet the requirements of any suit however complicated.

PLEASURE AND PAIN, LAWS OF. One of the great problems of psychology is the endeavour to construct some intelligible theory of the relations of pleasure and pain. A few leading principles now meet with general assent, and doubtless are destined to indefinite expansion as our knowledge of mental phenomena extends. The following observations may be useful:—

1. Pleasure is always connected, even when due to physical causes, with some activity of the mind, and as a rule any moderate exercise of a mental capability, either in itself or through the activity of a physical organ acting on the nerves of sensation, is a source of pleasure. It is pleasant to see things and hear sounds, to dance, to eat, and to smell sweet odours—all being done in moderation. Moreover, to a certain point the pleasure increases as the stimulus increases. But at a point varying with the nervous power of each individual the strain becomes intense, and the pleasure rapidly passes into pain, caused by overstimulation. It is delightful to watch the dawn, and the pleasure increases as the light grows stronger; but when the actual blaze of the sun arrives, the pleasure not only passes into pain, but the organ is paralysed, the eye is blinded. Pain arises not only from excess of stimulation, but from a craving for stimulation, as the pains of silence, of hunger, of darkness, of ennui, &c., which those who have endured them know to be terrible. Pleasure is found, then, only in moderate and varied mental or physico-mental activity: all other states are states of pain.

2. It may have been observed that not only moderate

but *varied* activity was postulated; and this brings us to the second principle, the pleasure of change. A stimulus, even of great moderation, if long continued, either ceases to excite or becomes painful. The man that has never really been hungry in his life has never known the keenest pleasure that eating can afford. Nothing is so conducive to rousing an invalid from the depression of illness as change of air and scene: it is as beneficial for dwellers on the coast to seek an inland resort as it is for inland folk to fly to the seaside. The change may be, as here, of kind; or of degree only, as when we escape from noise into comparative silence, or from the repose afforded by a chair when we are fatigued to the more complete repose of bed. The great thing needed is change, whether it be of one sort or the other. Those who are engaged in bodily labour know the pleasure of passing to mental occupation, and the equal pleasure of resuming bodily work: and a less pleasure, but one sufficiently keen, is afforded by change of one train of thought for another. But of course it is not to be supposed that the bodily labour, or the first mental exercise, is to be pushed to the point of exhaustion, as in this case no nerve-power remains for the enjoyment of the succeeding mental activity, which accordingly becomes a mere weariness and source of additional fatigue. Those who argue that farmers should be diligent students in their long evenings fall to wreck upon this rock, the outdoor labour being often so excessive as to render any further activity, even of a completely varied kind, irksome and perhaps impossible. If we are to put this doctrine into one word, we may say that pleasure is *relative*, not absolute, in the vast majority of cases, though not perhaps in all. It is not necessary to go as far as Plato, who declares that pleasure is simply relief from pain, and, therefore, cannot be attained without a previous pain; for this, it is not very difficult to show, is quite falsified by our present larger psychological knowledge.

3. But if excess of stimulation drives us over the borderline of pleasure into pain, what becomes of us if this excess still continues? The answer was contained in the illustration given above of the pleasure of watching the dawn ending in paralysis of the eye by the blaze of the sun. Long-continued excessive stimulation deadens, or wears out, the nerves. Heavy sorrow produces an almost fatalistic indifference; severe bodily pains end in a benighted numbness, which releases the sufferer from his agony. It seems, then, that for pains as for pleasures, variety is necessary if we would maintain their sharpness. Nothing is ever so intense in repetition as in its first occurrence. The first ball or play, the first hearing of superbly perfect musical tone, the first consciousness of beauty in one of the opposite sex, the first full sensation of each kind is the keenest. With each successor the fatal enervating force of habit acts more and more. The same is perfectly true of pains. The pains of cold and hunger are far keener to the shipwrecked saloon passenger than to his comrade of the stowage. In no case is the deadening power of habit shown in a more impressive, not to say awful manner, than in the opium-eating experiences of De Quincey (“Confessions of an Opium-eater”) and of Coleridge. Fortunately for men of science, and for mankind in general, the first of these sufferers has left a permanent record of his agony, forming one of the most valuable and remarkable little books ever penned.

4. Habit, while it dulls sensation, yet itself produces a peculiar series of faint (but very decided) pleasures and keen pains. The man of business disturbed from the routine of years (provided it is not a painful routine) is ill-at-ease, he craves for his desk; and if he returns to his accustomed life, he has a sense of well-being none the less decided for being, perhaps, almost unconscious. The frequent stimulus reduces the pleasure, but largely augments the craving for it when it is absent. De Quincey’s

book depicts the anguish of one striving against the craving of a bad habit.

We have here two opposite tendencies, as it seems. Variety is an element of pleasure, but complete and total change brings the pains of interrupted habit with it. We see, therefore, that the pleasure of novelty and variety has a very definite limit—it is no longer pleasurable when it involves a break in the continuity of our life, supposing that life to have been one of tolerable ease hitherto. Many of the ills of unsuccessful marriage unions are due to the total break with a previous life which one or the other partner has rashly made.

Two schools of ancient philosophy, the Cyrenaics and the Epicureans, perceived the importance of pleasure as a factor of life. This importance can scarcely be overestimated. Pleasure is vitalizing, pain is deadening. Pleasure not only quickens the powers, but is in turn quickened by them; the healthier the sense, the keener the pleasure derived from its activity. Every response to pleasure, moreover, strengthens the susceptibility for that pleasure. It is on this account that it is so dreadful a crime to repress and stifle the pleasurable activity of children, stunting for ever their mental growth, and casting a permanent shade over the brightness of their lives. Nothing can so deeply influence the happiness of life as the early formation of habits of right feeling, cherishing a readiness to find pleasure in sources of permanent enjoyment, and suffering to fall into decay, by disuse, those pleasures which are selfish and temporary, or have an element of baseness in them.

PLEBISCITE. In ancient Rome a *plebiscitum* was a decree made by the people (Lat. *plebs*) in the Comitia Tributa on the proposition of a tribune. The patricians accordingly denied that the plebiscita were binding on them, as they were voted in their absence and without their sanction; and to meet their objection the Lex Hortensia was passed, by which plebiscita were made to have the full effect of laws and be equally binding on all.

In the admiration and imitation of classic antiquity, which was so much the fashion during the first French Revolution, the term "plebiscite" was adopted for a resolution submitted to the popular vote, but both the word and the practice passed away with the Revolution. It was revived, however, in 1852, for the election of Prince Louis Napoleon as president of the French republic, and his subsequent assumption of imperial power and other measures were sanctioned by it. In Switzerland the popular vote on great constitutional questions, though denominated a *votation*, is essentially a plebiscite.

PLEBS, PLEBEIANS. Certainly the most instructive, interesting, and best known political development is that of the plebs of ancient Rome. The history of its origin, of its struggles, first for freedom, then for equality, and finally, of its complete victory, never ceases to find expositors or students, nor to yield counsels and warnings to statesmen.

The ancient Roman state, in the earliest times, consisted of the burgesses of the city of Rome, the fathers (Lat. *patres*) or patricians, under their king. These burgesses came to extend their protection over innuigrants into the city who were not burgesses, so that each burgess had, beyond his "family" of slaves, a large group of *clients* ("listeners," i.e. persons attentive to his behests); and the body of clients, as soon as it grew great, was collectively called the *plebs* (*pleo*, *plenus*), that is, the multitude. Indeed the word might almost be translated "mob," and was often used contemptuously or derisively. Each patron protected his own clients, stood for them in all legal matters as their representative, taxed them if he chose, and punished them as he saw fit.

From these narrow relations the first step was made by the great growth of the plebs, and the consequent attain-

ment of property by them, and assumption of independent legal existence as proprietors, as well as by their freedom to marry and to distribute and devise property, as well as to rule their families in the same fashion as the patricians ruled theirs. As neighbouring towns were subdued by Rome the plebs grew enormously, since it was manifestly impossible, to say nothing of its being wicked, to enslave all the valorous opponents of the growing city, and, on the other hand, the right of full citizenship was very jealously regarded and charily bestowed. At first, only the burgesses went on military service, and probably it was because their numbers began to thin that King Servius Tullius organized the state anew as to military matters, classing patricians and plebeians alike by centuries, and making service in the field a duty and not a privilege. But freedom to serve of course led at once to freedom to command, and plebeians began to rise to posts of honour.

By the time the Tarquins were expelled and royal Rome made way for the mighty republican Rome (B.C. 510), the plebs had become in truth the nation's strength. It had been excluded from the burgess-assembly where the whole people (patricians) met to pass laws, but the king represented its interests, and no evil seems to have been felt. The patricians had become an aristocracy, and the state was governed by a house of lords, under a king. When the kings were driven out this state of things could not continue, and the plebeians demanded and received admission on terms of full equality to the public burgess-assembly, the *comitia curiata*, and the national military assembly of the centuries, *comitia centuriata*, which henceforth drew to itself nearly all political power. The patricians favoured this latter change, because the centuries rested on a property basis, so that their great wealth permitted them to equal or surpass the plebeians in voting power, whereas, in the *curiata*, all burgesses were equal.

These changes carried with them the admission of plebeians to the senate, which had grown into a powerful governing assembly of men of note, who were members for life when once appointed, and in whose hands rested the authority of the state, wielded by means of the consuls and other great officers. These great magistracies were retained exclusively by the patricians, and the priesthoods, augurships, &c., as well; and the ranks of the patricians were kept close by the continued denial of the right of intermarriage with plebeians. The admission to the senate would appear to be a democratic victory on a first glance, but it was in truth the opposite. The plebeians, incapacitated for office and devoid of experience therefore in state affairs, were in a minority, and were only admitted in the persons of a chosen few, the privilege being doled out to rich or powerful plebeians to keep them quiet. Such men speedily took the tone of the aristocratic assembly, and plebeians though they were, haughtily held themselves above the common herd. The measure was intensely conservative and aristocratic in its effect.

As soon as this was felt the great body of the plebs, grievously disappointed, and daily more and more humiliated and burdened, reached at last the point of revolution. But the grandeur of the Roman people was shown in the nature of the revolution. No rushing to arms, no needless bloodshed, took place. The plebs retired in a body from Rome (B.C. 495), and the vast secession showed the aristocrats their own weakness and the overwhelming strength of their opponents. The dictator, Marius Valerius, negotiated with the latter in their bivouac between the Tiber and the Anio, a few miles from Rome; his timely concessions gained him the surname of *Mazimus* (greatest) from the thankful plebeians, and they returned to the city. The hill they had encamped upon was called the Sacred Mount ever after. Valerius had relieved the people from certain crushing laws of debt, the most pressing cause of the secession; and he instituted two new powerful officers of the state, the "tri-

bunes of the plebs," with large rights of control over the power of the patrician officers, the consuls, &c. The tribunes might veto any measure, and might try criminal cases and pronounce sentence without limit, defending themselves, if called in question, before the people in the national assembly. Almost immediately afterwards the tribunes obtained the power to bring in bills and initiate legislation. The tribune's door was to stand open day and night, that all men might appeal instantly to him, and he was forbidden to leave the city. To insure his power he was permitted to summon any burgess before him on suspicion or on information received, even a consul himself, accuse him, try him, and sentence him, if guilty, to a fine or to death. In addition to this a tribune's person was inviolable: at his election the whole nation swore to defend him during his term of office, and any one laying hands on him was outlawed.

Assuredly this tribunate was one of the most curious devices ever tried to escape from a political deadlock. That an official, who was not even a magistrate, and still less a commander, and had not even a seat in the governing assembly, should be able to exercise absolute prohibition against an otherwise absolute command, that in fact discord between the aristocracy and the common people should be thus legally recognized, organized, and provided for, is nothing short of startling. It only failed to cause disaster because of the strange law-abidingness of the Roman people, in which Englishmen are proud to resemble them. In fact the tolerable success of the Roman tribunate of the plebs shows that order and obedience to law depend on the temper of the people, not the well-doing of the people on the laws.

To trace the operation of this unique tribunitian power would occupy more space than could be spared; it would, in fact, almost amount to recounting the after-history of Republican Rome. The end of it was its absorption into the Empire, the emperors, beginning with the great Julius Cæsar, receiving the tribunitian power for life; and through this, and the "imperium," though the forms of the republic continued with consuls, prætors, ædiles, senate, &c., they kept absolute control of the state in their hands.

Returning to the fortunes of the plebs, the vast power of the tribunate served them to obtain victory after victory. The first was the breaking down of the marriage-barrier; and in B.C. 445, by the Canulian law, it was decreed that marriage between the two orders was legal, the children following the rank of the father. The patricians were driven from one position to another, and as a last desperate resource agreed to abolish the consulate, and govern by new officers, called "military tribunes," with consular power, six in number, plebeians being eligible to this office, but all the curule magistracies remaining exclusively patrician. The object of this was to limit admission to the nobility, the military tribunes being lords for a year and then retiring to private life (as in the case of the Lord Mayor of London among ourselves), the consuls becoming members of the senate, *i.e.* life-peers, or laying down their office. The dignity of the military tribunes was also lessened by the institution of two new patrician magistracies, the censorship, controlling the burgesses and taxation rolls, and filling up vacancies in the senate, &c., and the quæstorship, controlling the finance. The next victory of the plebs was to establish the right of the plebeians to stand for the quæstorship, B.C. 445; but it was not till B.C. 409 that the first plebeian was actually elected. It was still later (B.C. 400) before the election of the first plebeian to the military tribunate. In the year B.C. 378 came the final struggle, which lasted for eleven years, and ended in the passing of the Licinio-Sextian law, whereby military tribunes were abolished in favour of consuls, one at least of whom should

be a plebeian; and at the same time admission to one of the great religious colleges was granted to plebeians, with further diminutions of old patrician assumptions of exclusive right over common lands, of harsh powers over debtors, &c. To commemorate this great measure, passed B.C. 367, M. F. Canillus founded the famous temple of Concord at the foot of the Capitol, the foundations whereof still remain to receive our veneration as one of the landmarks of history. The patricians once afterwards elected two consuls of their order, B.C. 344, but instantly the tribunes brought in and passed a law to admit the plebeians to both consulships. Further, a sort of third consulship, specially concerning itself with legal matters, was created by the patricians at the time of passing the Licinio-Sextian law, and limited to their order. This was the prætorship. At the same time curule ædiles were created to govern markets, police courts, &c., which they intended also to keep as a patrician office—the ordinary ædiles or police magistrates being usually plebeians. But this new magistracy was almost immediately forced by the plebeians, and their gradual progress could no longer be arrested. The dictatorship had been thrown open to them B.C. 356, and he mastership of the horse B.C. 368. They now proceeded to acquire the right to both censorships in B.C. 351, and to the prætorship B.C. 337. In B.C. 339 the now triumphant plebs actually carried the war into the enemy's camp, and excluded the patricians from one of the censorships, while by the Licinio-Sextian law they were already excluded from one of the consulships.

There still remained the great religious colleges of the pontifices and augurs, repositories of jealously-guarded law rules, governing festivals, regulating the months, controlling elections and ceremonies, &c. In B.C. 300 the Ogulnian law threw these colleges open to plebeians, and the last fight was won. Even the tribunes of the people, heretofore allowed to sit on a bench at the door of the senate house only, a position technically regarded as being "out of the house," were at length admitted to the senate as magistrates of rank.

But with every defeat the pride of the patricians seemed to become more and more exclusive, and an example may serve to show their temper. A patrician lady married a plebeian consul. At once her relatives cast her off, and as a mark of this refused to worship with her in the temple of Chastity. The plebeians, not to be outdone, built their own temple; and thenceforth two goddesses of Chastity, one patrician and one plebeian, received worship at Rome.

From the fusion of the two orders, and the rise of great plebeian governing-families (*gentes* or clans), rivalling in exclusiveness and power the original patrician *gentes*, there came about that overpowering strength of the senate which marks the oligarchical period of the Roman republic, and which, when it degenerated into a tyranny, prepared the way for the empire. It would be most interesting to consider how far this oligarchical spirit might have been overcome by a frank welcome of the plebeians to full citizenship on the part of the patricians, and how far it was produced by the facts as narrated. Without entering on such speculations, however, the obvious reflection may be permitted that this struggle for and against equality between two nations (as they might at first almost be called), lasting for two centuries as it did, and fought out all along with constitutional weapons only, as it was, shows the superior power of such arms to those of brute force to achieve a complete and lasting political conquest—an assertion proved, if it needed proof, by the utter failure of the opposite course, which, when embarked upon two centuries later, gave first the aristocrat Sulla his blood-stained victory and despotism, and then the democrat Marius his equally sanguinary counter-despotism, and between the two ruined the republic altogether, and changed the face of the world.

PLECTOGNA'THI is a small order of fishes belonging to the subclass **TELEOSTEI**. The Plectognathi are remarkable for the bony armour in which some of the order are incased. In the coffer-fishes (Ostraciontidae, Plate, fig. 2), the body is covered with ossifications of the skin in the form of large plates immovably united together to form a firm carapace. The file-fishes (Balistidae, fig. 1) have the skin covered with small movable horny plates. The globe-fishes (Gymnodontidae, fig. 3) have a thick scaleless skin, in which bony spines are embedded. Lastly, in the sun-fishes (Orthogoriscidae, fig. 4) the skin is naked in the adult, but in the young fishes contains small spines. The skeleton is incompletely ossified, and the number of vertebrae is very small compared with most fishes, the coffer-fish having only fourteen. There is a soft dorsal fin placed far back near the tail, and opposite to the anal; the ventral fins are either absent or reduced to bony spines. The maxillary and intermaxillary bones are firmly united to form the upper jaw. In the file-fishes and

three strings—seventy-five strings in all. For the national instrument of Egypt, *el' oud* (lute), the favourite plectrum is the quill of an eagle's feather, which they call *rychet en nefr*.

PLEDGE is a thing bailed (delivered for a temporary purpose) as a security to the bailee (receiver), for the performance of some engagement on the part of the bailor (the deliverer). When the pledge is for a debt, more especially where it is given to secure a loan at interest, it is commonly called a pawn. The pledge is sometimes, though rarely, given for the sole benefit of the pledgee, as where, after a contract is made, one party gives to the other a pledge for its performance. Secondly, which is the ordinary case, the pledge may be for the mutual benefit of bailor and bailee, as in the case of a loan of goods on hire, or of money at interest, when the receiver of the money or the goods delivers to the other party something of value as a security. Thirdly, the pledge may be given for the purpose of obtaining a gratuitous loan of goods or of money, or of

procuring some other advantage to the bailor only. It would appear that in the first of these three cases the bailee would be liable for the consequences of slight negligence; in the second, for the consequences of the want of ordinary care; and in the third, for gross negligence only.

The pledgee is bound to return the pledge and its increments, if any, upon being requested so to do, after the performance of the engagement. This duty is extinguished if the pledge has ceased to exist by some cause for which the pledgee is not answerable. When the full amount of the debt or duty therefore is tendered and refused, and the pledge is detained, the pledge is at the sole risk of the

pledgee. In every case where the pledge has sustained injury from the wrongful act or default of the pledgee, the owner may recover damages to the amount of the injury in an action on the case.

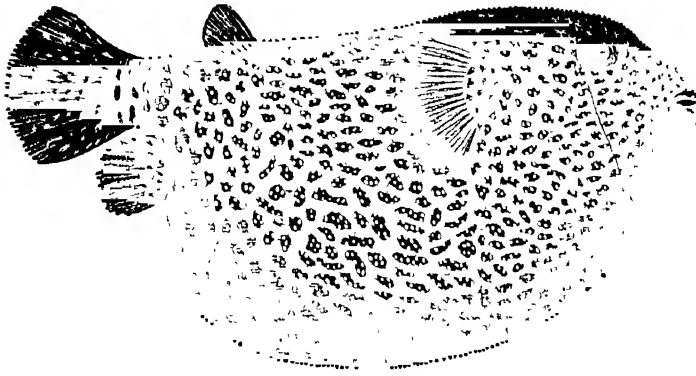
The contract of pledge may be extinguished by the performance of the engagement for which the pledge was given, or by satisfying the engagement in any other manner, either in fact or by operation of law, as by the acceptance of a higher security without an express stipulation that the pledge shall continue.

If the engagement, to protect which the pledge is given, be not performed within the stipulated time, the pledgor may sell, upon giving due notice to the pledgor. If no time be stipulated, the pledgee may give notice that he requires a prompt fulfilment of the engagement, upon non-compliance with which he may sell.

The possession of the pledge does not affect the right of the pledgee to enforce performance of the engagement, unless there be a special agreement, by which he has engaged to resort to the pledge only, or to look to it in the first instance.

Though the pledgee may sell, he cannot appropriate the pledge to himself upon the default of the pledgor; nor is he at liberty to use it without the permission of the owner, expressed or clearly implied. Such an implication arises where the article is of a nature to be benefited by or to require being used, in which latter case the use is not only justifiable, but indispensable to the discharge of the duty of the pledgee.

In Scotland, the law of pledge is derived from the civil or Roman law, though the effect of the English law is traceable. The term *bail*, with its derivatives *bailment*,



Globe-fish (*Tetodon meleagris*).

coffer-fishes the jaws are furnished with distinct teeth, while in the globe-fishes and sun-fishes the bones of the upper and lower jaws are more or less blended together, forming a sharp cutting beak (see cut). The gills are comb-shaped; the gill openings are very narrow, placed just in front of the pectoral fins. An air-bladder is present, not connected in any way with the alimentary canal.

Four families are contained in this order, Ostraciontidae (COFFER-FISH), Balistidae (FILE-FISH), Gymnodontidae (GLOBE-FISH), and Orthogoriscidae (SUN-FISH).

PLECT'NUM (Gr. *pléktron*, from *pléssō*, to strike), the little instrument of ivory, tortoiseshell, &c., with which the performer struck the strings of the classic lyre. The modern use of the plectrum is rather to *pluck* than to strike. Plectra are made of metal and of quill as well as of the materials above named.

Besides the lyre and cithara of antiquity, there are modern instruments played with a plectrum, such as the mandoline and zither. The lurspichord (with the spinet and virginals) was strictly a plectral instrument, the "jacks" being armed with quills, which plucked the strings as they were driven past them by the action of the key. The harp is often spoken of as a plectral instrument, though incorrectly, as the strings are always plucked by the finger-tip, and not by a plectrum. The favourite instrument of the present day in Turkey and Arabia (and to a less extent in Persia) is the *kanon* or *qanon*, a kind of dulcimer, with catgut strings, played with two plectra, one on the forefinger of each hand. These plectra are always of tortoiseshell, tipped with cocoa-nut shell, unless they are of silver. There are twenty-five notes, each with

bailee, &c., used in England, is unknown in Scotland in this branch of law. It may be noted that in Scotland a pledge cannot be sold without judicial authority, and therefore, when a sale becomes necessary, the proper course is to apply to the judge ordinary for a warrant to sell the article by public sale, the pledger being called as a party.

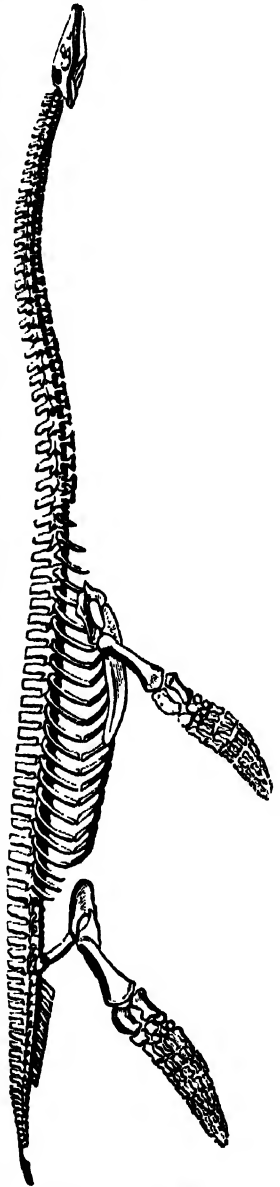
PLEIADES, THE, in classical mythology, were seven sisters who are described as daughters of Atlas and Pleione, a daughter of Okeanos, the Titan sea-god. Having committed suicide through grief at the death of their sisters, the Hyades, they were translated to the skies, and metamorphosed into stars at the back of the constellation Taurus. One of these (Sterope) has since disappeared. Various myths and legends are in existence respecting the Pleiades, another of which is, that they were companions of Artemis (Diana), and being pursued by Orion were rescued from him by the gods by being translated to the sky. The lost *Phæriad* furnishes a favourite poetical allusion. The usual account in the classic poets was that she had fallen in love with a mortal and had hidden herself from shame, while her six sisters were the spouses of different gods. Their names are—Electra, Maia, Taygete, Alcyone, Celæno, Merope, and Sterope. The title has also been given to any group or assemblage of seven celebrated persons; and especially to that famous group of seven literary men headed by Ronsard and Du Bellay, who, in the middle of the sixteenth century, undertook, and indeed in great part carried out, the creation of a regular and systematized language and style in France by the study of the ancient classical tongues. See RONSARD.

PLEISTOCENE PERIOD (Gr. *pleistos*, most, and *kainos*, recent), in geology, one of the latest divisions of the Tertiary epoch. It immediately preceded the age when man had sufficiently advanced in civilization in the European area to engage in the pursuits of agriculture and possess domestic animals—a period to which Professor Huxley has proposed to restrict the term *Prehistoric*. During Pleistocene times man was in the condition of a hunter, living by the chase, and unacquainted with any other material for the manufacture of implements but bone and stone. Among the contemporary larger quadrupeds there were many species that have survived to the present day, while others have become extinct. Detailed particulars of Pleistocene deposits and their contained fossil bones are given in the article GEOLOGY.

PLESIOSAURUS is one of the remarkable extinct REPTILES characteristic of the Secondary epoch. The remains of the Plesiosaurus have been found in beds of the Lower Lias down to the Chalk in such abundance that its structure and probable habits are well known. Dr. Buckland gives an admirable summary of the form of this extraordinary animal. "To the head of a lizard it united the teeth of a crocodile, a neck of enormous length, resembling the body of a serpent, a trunk and tail having the proportions of an ordinary quadruped, the ribs of a chameleon, and the paddles of a whale." The skull is small and depressed, and the nostrils are placed far back, just in front of the orbits, as in birds. The eye has no sclerotic plates. The teeth are lodged in distinct sockets; they are long, slender, sharp-pointed, and with single fangs. The neck is very long, being composed of from twenty-four to forty separate vertebrae. The vertebrae of the whole backbone are ninety or more; their articulating surfaces are nearly flat. True dorsal ribs reaching down to the sternum are never present, but short ribs are present along the whole length of the backbone. The sacrum consists of two vertebrae. The sternum is only slightly developed, and corresponds rather to that found in the frogs than to the sternum of other reptiles. Both fore and hind limbs were well developed for swimming, and it is probable that the digits were inclosed, like those of a whale, in a common

skin. The pectoral arch is large, and there are no clavicles. The humerus is stout, curved slightly backwards, rounded at the upper end, and flattened below, where it articulates with two short, flat bones, the radius and ulna. The

carpus consists of six or seven bones in a double row, and is followed by five slender metacarpals. The five digits are made up of numerous phalanges, with the exception of the first, which has usually three. The pelvic arch and hind limbs are very similar in size and form. The body was probably quite smooth. Conybeare thus speaks of the supposed habits of this extinct form, which he first described in 1821:—"That it was aquatic is evident from the form of its paddles; that it was marine is almost equally so, from the remains with which it is universally associated; that it may have occasionally visited the shore, the resemblance of its extremities to those of the turtle may lead us to conjecture; its motion, however, must have been very awkward on land; its long neck must have impeded its progress through the water, presenting a striking contrast to the organization which so admirably fits the Ichthyosaurus to cut through the waves. May it not, therefore, be concluded (since, in addition to these circumstances, its respiration must have required frequent access of air) that it swam upon or near the surface, arching back its long neck like the swan, and occasionally darting it down at the fish which happened to float within its reach? It may perhaps have lurked in shoal water along the coast, concealed among the seaweed, and, raising its nostrils to the surface from a considerable depth, may have found a secure retreat from the assaults of dangerous enemies; while the length and flexibility of its neck may have compensated for the want of strength in its jaws and its incapacity for swift motion through the water, by the suddenness and agility of the attack which they enabled it to make on every animal fitted for its prey which came within its reach." About fifty species of Plesiosaurus have been described, chiefly from the Lias. They have been found in Britain, and also in Europe, India, Australia, and America. Some of the species must have been fully 20 feet in length.



Skeleton of Plesiosaurus.

A nearly allied form, *Pliosaurus*, with a large head and short neck, is found in Oolitic beds of Britain, while from the chalk of North America a number of allied forms have been described, one of which, *Elasmosaurus*, was upwards of 45 feet in length.

PLETH'ORA (Gr. *plethôrê*, fulness, in which sense it is used by the Greek medical writers) signifies a redundancy of blood. By the older writers the term was used to express an imagined superabundance of any of the fluids of the body; and the terms bilious, lymphatic, and milky plethora, &c., implied the existence of an excess of one or other of those fluids in the blood. By the majority of the physicians of the present day the term plethora is used only to express that condition in which the quantity of blood and its nutritive qualities exceed that standard which is compatible with present health or the prospect of a continuance of health.

PLEU'RA is the membrane which envelops the lungs and lines the cavities of the chest. On the walls of each cavity of the chest the *pleura costalis* (as it is here called) is formed by a sheet of fine and elastic cellular tissue, loosely attached to the ribs, intercostal muscles, and other subjacent parts. On the exterior of the lung the *pleura pulmonalis* is composed of a thin superficial layer of fine cellular tissue, and a deeper layer of coarser fibrous tissue, which, in most of the large quadrupeds, and in the seal and some other animals, is very elastic, and affords an important assistance in the act of expiration. The surfaces of the two portions of pleura are continuous with each other at the root of the lung; each is covered with a delicate layer of epithelium; and they inclose within them a space called the sac of the pleura, into which a small quantity of serous fluid is constantly secreted. This fluid moistens the opposite surfaces of the lung and of the wall of the chest, and permits their free motion upon each other.

PLEU'RISY or **PLEURITIS** is an inflammation of the PLEURA of whatever nature and extent. It may arise from local causes, such as wounds or bruises of the walls of the chest, the irritation caused by the splintered ends of a broken rib, or from the rupture of a plethistical cavity in the lungs causing an escape of air and matter into the pleural cavity, while it not unfrequently occurs as the result of some constitutional affection, such as the infectious fevers, rheumatism, gout, Bright's disease, &c. It may be single or double, according as one or both sides are affected, and it may be either simple or complicated, acute or chronic. The most common form of the disease, however, is that which arises from exposure to cold, and is termed acute pleurisy. In this the outset of the disease is, in the majority of cases, marked by sharp pains in the breast of a stabbing character, which are increased by the act of coughing preceded or accompanied by shivering and a feeling of chilliness. The pain is often very characteristic, but at other times is variable and even delusive. Most commonly it appears as a stitch in the side, about the level of the false ribs, and the pain is intensified by drawing a deep breath, by lying on the affected side, and by pressure as well as by coughing. The breathing is in consequence short and difficult, and it tends to become shorter and shallower as the disease progresses, the skin being hot and dry, the cheeks flushed, the countenance expressive of fear and anxiety, the pulse full and quick, and the urine scanty and high coloured. The temperature fluctuates, not rising so high as in cases of pneumonia, but sometimes reaching 104° Fahr., an elevation rarely exceeded, and the fever is attended with headache and disturbances of the digestive organs. In the early stage of the disease the opposed pleural surfaces become roughened as the result of the inflammation, and an examination by means of the stethoscope reveals the existence of "friction," a rough rubbing sound occurring during the respiratory act, and ceasing when

the breath is held. Sometimes the inflammation subsides, leaving the pleura uninjured, or adhesions may form between the opposed membranes, leaving the patient affected with permanent shortness of breath, or as most frequently happens, an effusion of serum may take place into the cavity between the membranes. The amount of this fluid may vary from an almost inappreciable quantity to several pints, and sometimes it degenerates and becomes purulent. When it is considerable in quantity it compresses the lung so that it cannot expand properly during respiration, while other organs, such as the heart and liver, may, in consequence of the pressure of the fluid, be shifted away from their normal positions. Where the fluid is present in any appreciable quantity, an examination of the chest reveals more or less bulging of the side affected. On percussion there is absolute dullness over the seat of the effusion, and on auscultation the natural breath sound is inaudible over the part.

The duration of an attack of pleurisy may vary from five or six days to as many weeks, some remnant of the disease being generally left after recovery, which may not disappear for months or even years. Cases of simple pleurisy without effusion usually terminate favourably, and are seldom dangerous to life. When effusion has occurred and there is fluid in the chest the prognosis is less favourable, though in uncomplicated cases where the effusion is moderate in quantity the disease is seldom fatal. Where the effusion is large there is more danger, and cases of empyema, i.e., those in which the cavity is filled with pus, are always of a serious character.

The treatment of pleurisy must of necessity depend, as regards details, upon the form and severity of the attack. In acute pleurisy it is very desirable that active treatment should be resorted to at the outset, and there are few maladies in which early attention is better rewarded. One of the first symptoms calling for treatment is the pain, which, though it usually passes off in forty-eight hours or thereabouts, is often very severe while it lasts. It may generally be greatly diminished by the application of a few leeches to the seat of the pain, the bites being allowed to bleed freely into a large poultice. Where it is not desirable to employ leeches, much relief may be obtained by the use of hot fomentations or poultices sprinkled with turpentine. The application of a tight flannel bandage will moderate the pain by restraining the movement of the ribs, but strapping the chest on the affected side with broad strips of sticking plaster is much more effective. After effusion has taken place counter-irritation by means of blisters or iodine may be required, with the internal use of saline cathartics, diuretics, and diaphoretics. The diet must be light and simple, and the patient should be kept closely to bed. In some cases the operation of removing fluid from the chest (*paracentesis thoracis*) must be resorted to. In general this operation, which was known to the ancient surgeons, but has only been adopted in modern practice during the last quarter of a century, is unattended with danger and is almost painless, while its beneficial results are of the most marked character. The chest is punctured in the lateral or posterior regions, and by means of an instrument termed the pneumatic aspirator, the whole or the greater part of the fluid may be withdrawn. Where there is any evidence that the fluid is purulent, the operation should be performed early, and it is sometimes necessary to establish for a time a drainage of the pleural cavity by surgical measures.

PLEURONEC'TIDÆ. See FLAT-FISH.

PLEU'RO-PNEU'MO'NIA, in medicine, is the name given to a combination of inflammation of the pleura and of the lung itself. All cases of acute pneumonia are attended with a certain degree of pleurisy, but in the majority of cases it is of little or no practical significance, and the term pleuro-pneumonia is restricted to those cases in which

the two morbid conditions give rise to their respective pathological changes, each influencing the symptoms and physical signs. No general rules can be laid down as to treatment, but every case must be regarded upon its own merits, and dealt with in accordance with the general principles indicated under LUNGS (DISEASES OF), and PLEURISY.

Pleuro-pneumonia in cattle is one of the contagious diseases specified in the Contagious Diseases (Animals) Act, and first appeared in England in 1841. It commences with a short husky cough, cold moist skin, and like symptoms, which cannot be mistaken by farmers who have had any experience of it in their herds. Chemistry and the microscope have as yet thrown very little light on the causes of the disease. The nature of the poison is not known, nor how it is generated or conveyed, whether wafted in the atmosphere like Asiatic cholera, or conveyed by other means. The remedies should be of a tonic character, and such as promote the action of the liver, bowels, and kidneys. The body must be clothed, the legs bandaged, laxatives administered, and a daily dose of two ounces each of nitre and common salt in treacle and water. Stimulants must be administered, and the food must be restricted to bruised grain, flour, and treacle, and similar articles, light and easy of digestion.

PLEVNA, a town in Bulgaria, in the valley of the river Vid, a tributary of the Danube, 25 miles south-west of Nicopolis, memorable for the resistance it opposed to the Russian advance in 1877. It was an unimportant and open town until the Turkish commander, Osman Pasha, surrounded it with intrenched works so successfully that for five months it withstood the assaults of the main body of the Russian army. Osman Pasha advanced from Widin with thirty-six battalions and forty-four guns to the relief of Nicopolis, but was too late for this object, and was allowed by the Russians to occupy Plevna unopposed on the 14th July, 1877. An attack by the Russians on 20th July was repulsed with terrible loss to the assailants, and as it was felt that the town must be taken at any cost a more determined assault was made on 31st July, which resulted in another complete defeat of the Russians. A general advance of the Russians being impossible with such a strong position in their flank, it became necessary to alter the whole plan of the campaign, and a period of inactivity followed, in which the Russians brought up reinforcements, and Osman Pasha strengthened the fortifications of Plevna. Early in September the Grand-duke Nicolas had 60,000 men under his command; but military critics considered this was barely half enough to insure a successful assault on the intrenchments. After four days' bombardment an assault was, however, made on 11th September (the czar's birthday), and in the presence of the czar himself. It was repulsed at all points except the centre, where the Roumanians captured a redoubt, and the south, where General Skobloff took two redoubts, but was compelled to retire from them on the following day. It was now, therefore, determined to turn the assault into a regular siege, and General Todleben, who had constructed the Russian works at Sebastopol in 1854-55, was placed in command of the Russian forces, with orders to invest the town and starve it into surrender. The Russians ultimately surrounded it on all sides, and their forces were strengthened by the arrival of the Imperial Guard. Week after week passed, and the Turks held out with heroic firmness till resistance was no longer possible; and accordingly, on 11th December, a supreme effort was made to break through the Russian lines. In this the Turks failed, and Osman Pasha and his army—reduced by this time to 20,000 men—were compelled to surrender. It was estimated that the Russians lost 25,000 men in the September assault alone, and that their total losses around the town amounted to nearly 50,000.

PLEY'EL, IGNAZ JOSEF, the musical composer, was born in 1757 at Rupperstahl, a small village within a few leagues of Vienna. He was the twenty-fourth child of Martin Pleyel, a schoolmaster of that place, and of a lady of noble family, disinherited by her parents on account of what they deemed so imprudent a marriage. She died in giving him birth. At the age of fifteen he was placed under the instruction of Haydn, with whom he lived five years, at the expense of 100 louis per annum—a large sum at that period, which was defrayed by the Count Erdödy, a wealthy Hungarian nobleman who, struck by the talents and manners of the youth, took him under his protection. In 1777 his patron allowed him to visit Italy, and at Naples his genius for instrumental music was first shown. In 1783 Pleyel was appointed chapelmaster of the cathedral of Strasburg, and from this time till 1793 scarcely any instrumental music was willingly listened to but that which he had created. In 1791, Saloman having engaged Haydn to compose symphonies for his concerts, the managers of a rival institution named the "Professional Concert" sent for Pleyel to supply works of similar kind; but in the contest with the father of this high class of composition he had no chance. Pleyel, however, realized £1200 in London, with which sum he purchased an estate near Strasburg. Suspected of aristocratic opinions, Pleyel was in 1793 denounced no less than seven times to the French republican authorities at Strasburg, and at length fled, but was pursued and taken. He obtained his liberty by writing music for the republic, under the guard of two gendarmes, and almost with the axe suspended over him. Pleyel sold his estate in 1795, went to Paris with all his family, and entered into a commercial speculation, becoming publisher of music and manufacturer of pianofortes, and founder (in 1807) of the well-known firm bearing his name. Haydn always considered Pleyel as his best pupil. Twenty-nine symphonies and a very large number of quartets and quintets attest the prolific nature of the composer. Pleyel died on the 14th of November, 1831.

PLI'CA POLO'NICA is the name given to a disease which is chiefly remarkable for the sticking together and matting of the hair, and which is peculiarly frequent in Poland. The disease chiefly affects the scalp. The hair is matted together by a sticky and most offensively-smelling secretion, and is commonly infested with vermin. The only treatment which is known to be constantly beneficial is the removal of the hair and strict cleanliness.

PLICATION OF STRATA. During the movements which the earth's crust has undergone, owing to contraction and subterranean disturbances, its component strata have been more or less bent and folded in nearly all arens through the agency of lateral pressure. Such is especially the case in the region of mountain chains; and the crumples vary from the most extensive arches and troughs to the most minute contortions. To the larger foldings a definite nomenclature has been applied by geologists. When a series of curves are all bent over and inclined in one direction, they are said to be *isoclinal* (Gr. *isos*, equal or same, *kline*, I bend), and the lower beds in each fold are *inverted*: good examples are found in all highly disturbed tracts, such as the Scotch Highlands, the Alps, and the south of Belgium. When the strata are arranged in the form of a dome or a basin-like hollow, they are termed *periclinal* (Gr. *peri*, around); and a *monoclinal* (Gr. *monos*, single) curve is produced when a set of horizontal beds is suddenly bent up or down into a sharp flexure, and then continued horizontally at a higher or lower level; the Eocene formations round London are periclinal, and a typical instance of the monoclinal curve passes through the middle of the Isle of Wight. Arched strata are *anticlinal* (Gr. *anti*, in different directions), and the troughs between anticlines are known as *synclinal* (Gr. *syn*, together) curves.

PLINTH (Gr. *plinthos*, a tile), the lowest member of an architectural design, originally representing, as it were, the broad flat tile or wide brick upon which the design might rest. From this the plinth developed into the general meaning of the lower projecting base of any column, pedestal, wall, &c.

PLINY THE ELDER (*Caius Plinius Secundus*) was born, as is commonly supposed, A.D. 23, either at Verona or at Como (Comum) in North Italy. He was of a noble family, served in the army, wrote history, practised as a pleader, was an augur, and afterwards procurator of Spain in the reign of Nero. In all his avocations he remained a hard student, a multifarious reader, and a most laborious compiler. He was abstemious in all things, an exact man of business, one who made labour his pleasure. The circumstances of his death are told minutely and well by his nephew in a letter to the historian Tacitus (Plin. "Ep." vi. 16). He had returned to Italy in 73, had adopted the younger Pliny, his sister's son, and had risen high in the favour of Vespasian. In 79 he was at Misenum in the Gulf of Naples, with a fleet under his command, with his sister and her son, the writer of the letter above mentioned. On the 24th of August, A.D. 79, there was an eruption of Vesuvius, and Pliny went in a ship from Misenum to the coast nearer the mountain, and thence to Stabiae, with a view to help the people who were threatened with destruction by the ashes and stones which the mountain vomited forth, and also to have a better view of this great phenomenon. While he was at Stabiae the eruption increased in violence, the ground shook with an earthquake, and he and his friends sought their safety by leaving the house. They made for the open country in the midst of thick darkness and showers of ashes, and were never more seen. Pliny fell down, suffocated, as seems most probable, by the sulphurous vapour.

The titles of several of his works are given by his nephew ("Epist." iii. 5); of these the only one that has come down to us is his "Natural History," which may well be called "a work of great compass and erudition, and as varied as nature herself." It consists of thirty-seven books, all of which are still extant, though the text is in many places in a very corrupt state, and several passages are quite lost. The first book is a table of the contents of the other thirty-six; the second treats of the world, the elements, the stars, the winds, &c.; the third, fourth, fifth, and sixth, contain a geographical account of the whole of the then known world; the seventh treats of the generation and organization of man, the most remarkable characters that have ever lived, and the most useful inventions; the rest contain a system of zoology, and of human and comparative anatomy (four books); botany, and vegetable medicines (sixteen); animal medicines (five); metals (two); colours and painting (one); stones and sculpture (one); gems (one).

This will give some idea of the miscellaneous nature of the contents of this extraordinary work, and if the judgment of the writer had been equal to his industry and learning, it might well have been considered as one of the greatest monuments of human ability. But it is simply an immense collection of facts, not facts observed, but facts, or supposed facts, which he found recorded. These have been selected with little discrimination, nor have they been combined into any system. Pliny has not always correctly represented the meaning of the authors from whom he has taken them; and his work is of little value for modern science. The part which treats of geography is brief and confused, and yet it contains much valuable information; and what he has said of painting, sculpture, and the arts generally, is useful both for the history of art and its practical details. Besides his many considerable works, Pliny left his nephew 160 volumes of closely written notes on all kinds of subjects. The younger Pliny might well say that compared with his indefatigable uncle the

most diligent literary men might seem to produce nothing. The good man began to study at one or two in the morning, repairing to the Emperor Vespasian before light for literary and confidential talk. He would then return home and continue hard study till the noontide meal, after which he rested by taking notes while a slave read to him. Even to the bath he took his reader and his note-book; and still continued to dictate or to listen to reading while he took his dinner (see "Letter iii." of Pliny the Younger).

The best critical edition is that of Sillig (Leipzig, 1831-36, 12mo, five vols.), which contains the various readings of a MS. at Bamberg, which had never before been collated. Pliny's work has been translated into many languages. There is an English translation by Holland (1601, London, two vols. folio).

PLINY THE YOUNGER (*Caius Plinius Cæcilius Secundus*) was born at Como (Comum), A.D. 61 or 62. His father Caius Cæcilius, who was of an equestrian family, died young, and the son was adopted by Pliny the Elder, who was his mother's brother. Caius was a precocious youth; he wrote a Greek tragedy when he was only fourteen. At the age of nineteen he practised in the court of the Centumviri, and he afterwards appeared as an advocate in causes tried before the senate. He also served in the army. In 103 he was appointed by Trajan procurator of Bithynia. Pliny was a pupil of the orator Quintilian, and a friend of the historian Tacitus. He was a man of mild and generous disposition, rich and munificent. He was twice married, but left no children. The time of his death is not known.

Of his numerous works, his "Epistles," in ten books, and his "Panegyric on Trajan," are all that remain. The first nine books of the Epistles are addressed to various persons; the tenth contains the letters to Trajan and the emperor's answers. The collection is instructive and amusing, though it has one defect—many of the letters were written with a view to publication. This man, who was kind to his slaves, was severe to the Christians; much severer than Trajan, whose remarks on the case of the Christians of Bithynia were in favour of a milder treatment than his governor recommended and practised. There are numerous editions of the Epistles and Panegyric. The best is that by Professor Mommsen (Leipzig, 1870). A good English edition of the chief letters, with notes, was produced by Church and Brodribb in 1871, and an English translation by the same authors appeared in "Collins' Ancient Classics" in 1872.

PLIOCENE (Gr. *pleion*, more, *kainos*, recent), in geology, the term applied by Sir Charles Lyell to that late division of the Tertiary period in which the still living species of mollusca predominated over those that have subsequently become extinct. During this epoch, the British area appears to have been chiefly land and connected with the rest of Europe, so that Pliocene strata have only a comparatively small development in this country. The whole series is scarcely more than 140 feet in total thickness, and is confined to the eastern counties of Norfolk, Suffolk, and Essex, with the exception of a small deposit recently discovered in the neighbourhood of St. Erth in Cornwall. The latter was described before the Geological Society in 1884 by Mr. Searles Wood, and again in 1886 by Messrs. Kendall and Bell. The strata of the typical eastern district consist chiefly of old marine shell-banks, and are usually regarded as divisible into three groups in the following stratigraphical order:—

NORWICH CRAG (uppermost).

RED CRAG.

CORALLINE CRAG (lowermost).

These are described in detail under their respective names.

On the continent of Europe, the Pliocene strata are most extensively developed in Italy and Sicily, though

other important deposits also occur in Central France and in Greece. In Sicily these rocks attain a thickness of about 700 or 800 feet, and are said to cover nearly half the island: it is also interesting to note that they are occasionally found at a height of no less than 3000 feet above the level of the sea—a fact that indicates the comparatively recent upheaval of the mountains of those parts. The fossil shells are remarkable for their close resemblance to those now living in the Mediterranean. In Italy, there are late Pliocene formations in the valley of the Arno, about 10 miles above Florence, which occupy the site of an ancient lake and entomb the remains of large numbers of land animals in addition to plants. Among others there have been discovered bears, hyenas, elephants, mastodons, rhinoceroses, hippopotami, and true horses. In the same country there are also extensive marine deposits of older Pliocene age: these form the low range of hills bounding the Apennines on both sides, and are hence termed the *Subapennine strata*. Their fossil remains belong to species remarkably similar to those now inhabiting the Mediterranean, but they are often of larger size, indicating a warmer climate, and are associated with other types at present confined to tropical seas. In France and Greece the rocks now usually assigned to the Pliocene period are of fresh-water origin, and so yield numerous remains of land animals, just as in the case of the Val d'Arno accumulations; the latter fauna, however, belongs to a late phase of this period, while the French and Greek fossils seem to date back to its earliest part. The beds of PIKERMÍ in Attica have hitherto furnished the most extensive collections.

Pliocene strata are also found to occupy a large area in India. They are especially well developed in the Siwalik Hills, a low range bordering the Himalayas on the south, and consist of fresh-water deposits of sandstones, conglomerates, clay, and marl. This SIWALIK FORMATION is of the greatest importance, from the abundance of its contained fossil bones and teeth, and on account of the light which these throw upon the evolutionary development of the higher quadrupeds. Similar fossiliferous accumulations have also been discovered in Persia. See also GEOLOGY.

PLOCK or **PLOTZK**, the capital of the Russian government of the same name, is situated on the Vistula, 68 miles W.N.W. of Warsaw. The population is about 20,000, many of whom are Jews. Plock gives a title to a Roman Catholic bishop, who resides at Pultusk. There are in the town a cathedral, eleven churches, five convents, an episcopal palace, a Piarist gymnasium, a seminary of secular priests, an orphan house, a lunatic asylum, a literary society, theatre, &c. The inhabitants subsist partly by agriculture and partly by a brisk trade with Dantzic and other places.

PLOMBIÈRES, a favourite watering-place in the north-east of France, in the department of Vosges, on the Angnonne. Its population does not exceed 2000, but its warm saline baths are much frequented. The springs were known to the Romans, whose baths are in a wonderful state of preservation. The waters contain a glutinous substance, like those of Barèges. The name was formerly Plumbières, and has nothing to do with lead.

PLOTINOS (Lat. *Plotinus*), the chief of the Alexandrian Neo-Platonists, is said to have always refused to divulge the names of his parents and the time and place of his birth, so little reason did he think he had to congratulate himself on having been born. His contempt of physical necessities was such that he would blush at the thought of being compelled to have a body. It is believed that he saw the light at Lykopolis in Egypt in 205. At the age of twenty he went to study in Alexandria, which for long had been celebrated for its commercial prosperity, and for the variety and activity of its literary institutions. In the first

centuries of the Christian era this city was the gathering-point of the learning of the East and of the West. Here were collected together, as in a vast reservoir, the Greek philosophy, the Oriental mysticism, the ancient superstitions of heathendom, the rising power of Christianity, the heresies of Gnosticism, and the doctrines of the Jewish kabbalah; and in the midst of the fermentation of these elements the Alexandrian philosophy arose, an effort on the part of expiring paganism to rally and organize her forces. When Plótinos came to Alexandria Ammónios Sakkas was at the head of this philosophy—was, indeed, its reputed founder. Some years elapsed before Plótinos made the acquaintance of Ammónios, whose devoted disciple he then became, and to whose instructions he listened assiduously for eleven years. In his thirty-ninth year Plótinos, being anxious to extend his knowledge by a more intimate acquaintance with the philosophy of the East, joined an expedition which the Roman Emperor Gordian had equipped for the invasion of Persia. The issue of the expedition was disastrous. Gordian was assassinated in Mesopotamia, and Plótinos with difficulty escaped with his life. This expedition having brought him into close relations with the Romans he betook himself to Rome in the fortieth year of his age. Here he resided until his death, expounding the Alexandrian philosophy, of which he has a better title than Ammónios to be regarded as the originator. At any rate he amplified it greatly, and by him it has been handed down to posterity. He had a project of founding a city in Campania on the model of Plato's republic, but the ministers of the Emperor Gallienus, who had expressed great favour towards the scheme, induced him to change his mind and to refuse to assist the philosopher to its realization. Plótinos died at Rome in his sixty-sixth year, in 270.

Plótinos had many pupils and admirers. Of these the most faithful and intelligent was Porphyrios (Porphyry), and to him he intrusted the arrangement and publication of his writings. They consisted of fifty-four books, which Porphyry divided, according to their subjects, into six parts. Each of these parts contained nine books, which he called "Enneads," from the Greek word signifying nine. The philosophy of Plótinos, divested of its mystical complexion, presents to us the following principal points, which may be shortly exhibited in the form of question and answer:—(1) What does philosophy aim at? At absolute truth. (2) What kind of truth is that? Truth for *all* intelligence; a truth which any intellect is necessarily shut out from knowing is not an absolute truth. (3) What is the truth for all intelligence? Unity—the oneness of all things. (4) How so? Because while the diversity of things is addressed to what is peculiar to each order of intellect, their unity can be taken up only by what is common to all orders of intellect. Unity is thus the object of philosophical pursuit, inasmuch as it is the truth for all; in other words, the absolutely true. (5) But what is this unity? The Alexandrian philosophy is driven in upon the answer that *thought* is the unity of the universe. Hence the knowledge of self, the thought of thought, the reflection of reason upon itself, is inculcated by Plótinos as the highest duty, and as the noblest source of purification and enlightenment.

In this respect the Alexandrian scheme differs from all the systems which preceded it. They placed the absolute truth in something which thought embraced; this system placed it in the thought itself by which this something is taken hold of. Mixed with these speculations is a mass of almost unintelligible mysticism. The doctrine of *ecstasy* was a favourite one of the philosopher. This was akin to the Nirvana of the Buddhists, and consisted in a trance following prolonged meditation, wherein the soul became actually absorbed in deity. The only way to reach God—so Plótinos taught—is by thus escaping from the body. His disciple, Porphyry, records that Plótinos attained this

state to his knowledge more than once. The works of Plötinos, edited by Creuzer, were published at Oxford in 1885. They were recovered from oblivion by Ficinus, who made a Latin paraphrase of them at Florence in 1492, which was followed by the *editio princeps* in Greek of the original (Basel, 1580). Kirchhoff's edition (Leipzig, 1856) is among the best of the modern ones. There is no good English translation, but Bonillot's French translation (Paris, 1857-60) is readable; it has, moreover, an excellent commentary. A remarkably clear and sympathetic account of this interesting philosopher is given by Mr. Myers in his "Classical Essays" (London, 1883).

PLOT-INTEREST is a division of the emotions of action; it is the attitude of pursuit, the condition of suspense, marked on the physical side by the intent occupation of the senses, and on the mental side by some keen motive of interest in the end for which we wait, which interest is heightened as that end approaches until, at its climax, it engrosses us to the forgetfulness of ourselves. Within certain limits chance or uncertainty contributes to this engrossment. The lower animals show this emotion in pursuing their prey, and men in field sports. All business has it largely, all relations of sympathy, all strivings after knowledge blessed by gradual attainment. But the special cause of the emotion in its keenest purely subjective state is the fictional department of literature. The elements of chance and of partial concealment are always used largely by a skilful narrator; they are among his chief means to retain the interest of the reader.

The kindred form of pain which answers to the pleasure of plot-interest is due to the over-prolongation of the suspense, and is sometimes very keen.

PLOUGH. See AGRICULTURAL IMPLEMENTS.

PLOUGH MONDAY. The Monday after Twelfth Day, or the termination of the Christmas holidays, when the labours of the plough usually began in former times. It was formerly customary for farm-labourers to draw a plough from door to door on this day, and to solicit "plough-money" to spend in a frolic.

PLOVER is the general name of the Charadriidae, a large family of birds belonging to the order GRALLÆ. In this family the bill is usually shorter than the head, stout, hard, and convex at the tip, with the basal portion depressed and soft. The nostrils are situated in long grooves, which extend half the length of the upper mandible. The legs and feet are long and slender; the anterior toes are united by a small membrane at the base, and the hinder toe is usually wanting. The body is stoutly built and the wings pointed.

The Golden Plover (*Charadrius pluvialis*) is a well-known British bird, breeding in the more elevated parts towards the north, and to some extent passing the whole year in these islands. In the summer it resorts as far north as Ireland and Western Siberia for the purpose of breeding, wintering for the most part in Southern Europe and Northern Africa. The plumage of the upper surface is blackish, speckled with yellow at the tips and edges of the feathers. The lower surface undergoes a change of colour with the seasons, being deep black in summer and dusky-white spotted with yellow in winter. The whole length is about 11 inches. Like the other plovers this species associates in considerable flocks, and utters a shrill whistling note. It feeds upon insects, worms, and slugs. The four eggs are deposited in a hollow of the ground among the heath, this simple nest being lined with a few dry fibres and stems of grass. The young quit the nest as soon as hatched, and follow their parents till able to fly and support themselves, which is in the course of a month or five weeks. Towards the end of August these birds begin to leave the moors (having there congregated in large flocks), and descend to the fallows and the newly-sown wheat fields, where an abundance of their favourite food

can be readily obtained. At this season they soon become very fat, and are excellent at the table, their flesh being not inferior in flavour to that of the woodcock or any of our most esteemed sorts of game. The golden plover is represented in America by *Charadrius virginicus*, and in Eastern Asia by *Charadrius fulvus*. The DORREBEL (*Endromis morinellus*) is nearly allied to the golden plover, and is sometimes kept in the same genus, *Charadrius*.

The Gray Plover (*Squatarola helvetica*) is very similar in appearance to the golden plover, but is rather larger, and



Golden Plover (*Charadrius pluvialis*)

has a rudimentary hinder toe. It is very widely distributed in the northern and temperate parts of both hemispheres, and extends as far south in winter as South Africa, Ceylon, and Australia. In Britain it is a well-known winter visitor. In the colour of its plumage it is very like the golden plover, except that in the winter the upper surface is less black, being rather gray; the axillary feathers of this species are black, while in the golden plover they are white.

The Ring Plover (*Argalitis hiaticula*), a small species less than 8 inches in length, is a permanent resident in Britain, where it chiefly frequents the flat sandy shores of the sea. The eggs are laid in a slight depression in the sand. It is grayish-brown above, whitish beneath. On each side of the head is a large black spot, and across the lower part of the neck is a broad black band, leaving a distinct white collar round the neck. The Little Ringed Plover (*Argalitis curonica*) is a very rare visitor to Britain, but is common in Europe by the sides of rivers. It is distinguished by its smaller size and more slender form. The Kentish Plover (*Argalitis cantiana*) is found in the summer on the shores of Kent and Sussex, but is rare elsewhere in England, and unknown in Scotland.

The well-known "Plover's eggs" are laid by a nearly allied species, the LARWING (*Vanellus cristatus*). To this family also belong the Courser, Pratincole, Stone-curlew or Thick-knee, Turnstone, and Oyster-catcher, which are treated under their respective headings.

PLUM (*Prunus*) is a genus of trees and shrubs, natives of temperate regions in both hemispheres, belonging to the order ROSACEÆ, suborder DRUPACEÆ. The leaves are simple, alternate, and stipulate, and when young have their margins rolled inwards; they are generally produced after the flowers. The fruit is a drupe, ovate, or oblong, covered with a velvety bloom; the stone is pointed at both ends and furrowed along the edge. The flowers are solitary or in umbellate clusters.

There are three common species of the genus *Prunus*, not very distinct from one another—the Common Sloe or Blackthorn (*Prunus spinosa*), the Bullace (*Prunus insititia*) and the Common Plum (*Prunus domestica*). *Prunus domestica*, a tree from 15 to 20 feet in height, with branches usually devoid of spines, is the original of most of the

cultivated varieties. It is a native of the Caucasus and Asia Minor, has become naturalized in many parts of Central and Southern Europe, and is sometimes found in hedges in England. It was cultivated both by the Greeks and the Romans, the latter having many varieties, and among them the damson or damascene plum, brought originally from Damascus.

The Bullace (*Prunus insititia*), which is distinguished by having its flowers in pairs and its fruit globose, is wild in England and some parts of Europe and Western Asia. The fruit is usually black and less austere than that of the sloe, so that it is used for preserves, pies, &c. Some of the cultivated varieties are probably to be referred to this species.

The Sloe or Blackthorn (*Prunus spinosa*), distinguished by its dark purple spiny branches, is common in England, and is also found in Europe, Western Asia, and North Africa. The fruit is small, dark purple, and very sour; it is said to be employed largely in the manufacture of cheap port wine. The stones, both of the blackthorn and of the bullace, but not those of *Prunus domestica*, have been found in the Swiss lake-dwellings.

The cultivation of the plum is not difficult. The tree is harder than the cherry tree. The trees succeed in any free soil, not too dry, but by no means stiff or clayey. They are grown as standard, espalier, or wall trees, and are propagated chiefly by budding or by layers. Stocks for budding are obtained either by sowing the stones, or by the suckers thrown up by old-established trees. Seedlings produce much the stronger and longer-lived specimens, but are of slow growth during the first few years; nurserymen consequently often prefer to make use of suckers, which come to market more rapidly, but which make inferior fruit trees in the long run.

The wood of the plum tree is hard, close-grained, handsomely veined, and capable of receiving a high polish. Its colour is heightened by immersion in lime-water.

The varieties of plum are very numerous, and differ greatly in size, shape, and flavour. The earliest plum is the cerisette, of which there are red and yellow varieties. It opens clean, like the damson, leaving the stone loose and free, and is good though self-sown, or raised from stones. The mirabelle is an early sort of small light coloured plum, which bears abundantly, has quite a free stone, and is tolerably sweet. It is excellent in jam and also as a brandy-plum, having an aromatic flavour. The magnum bonum is a very large variety. Other varieties furnish the most delicate contributions to our desserts, as the greengage, for instance, which fully deserves the favour it has so long enjoyed.

The numerous ways in which plums can be prepared add considerably to their commercial value, and render their culture extremely important. They are made into preserves of different kinds, both with and without sugar. In the latter case, the cooking process is greatly prolonged, until the concentration of their natural sugar makes the addition of any other unnecessary. By fermentation, alcoholic liquors, raki, and zwetschenwasser are obtained from plums. Plums also are preserved, like cherries, in brandy; the smaller kinds, as the mirabelle, being preferred for the making of plum-brandy. Prunes or French plums are merely dried plums.

The Cherry Plum (*Prunus myrobalana*), a Canadian species, is cultivated chiefly for the sake of its ornamental flowers, which are produced in March and April. The globular red fruit is not equal to that of the common species, and is rarely produced in England. In India the fruit is sold to dye black. It forms a good stock for grafting varieties intended to be kept dwarf.

PLUMBAGINEÆ is an order of plants belonging to the group **GAMOPETALÆ**. They are herbs or undershrubs, with leaves either arranged in a cluster at the top of a

rootstock or alternate on a branching stem, entire, amplexicaul, exstipulate. The flowers are collected in spikes, panicles, or capitula. The calyx is tubular, persistent, sometimes coloured; the corolla is hypogynous, with a regular four-partite limb, or consisting of five petals cohering by their bases or quite free; the stamens are five, hypogynous when the corolla is gamopetalous, attached to the claws of the petals when they are free; the ovary is free, one-celled, with five distinct styles, and a solitary pendulous ovule. The fruit is membranous, included in the calyx, capsular, or utricular. About 200 species have been described inhabiting sea-shores and salt marshes.

Many species have active properties. The root of *Plumbago europæa* contains a caustic substance which was formerly used for toothache, skin diseases, and ulcers, and is now employed by beggars to raise sores upon their body. Some tropical species of *Plumbago* are cultivated in Europe as ornamental plants, as are also many species of the genus *Statice*, from Southern Europe, the Canaries, and Central Asia.

PLUMBA'GO or **GRAPH'ITE**, a natural form of nearly pure carbon, making a closer approach to the diamond than any other carbonaceous mineral. It has a dark gray colour and metallic lustre, and is soft and greasy to the touch; it usually occurs in lumps or nodular masses in gneiss, slate, and other primitive rocks, but is sometimes also found in the form of six-sided tabular crystals.

The name *plumbago* is said to be derived from the Italian *graffio piombino*, which alludes to the lead-like appearance of this mineral, and to its use in the manufacture of pencils; the former peculiarity has also given it the common name of "blacklead" in Britain, and the term *graphite* is derived from the Greek *grapho*, I write. The manufacture of PENCILS is described in the article under that heading.

Pencils were first manufactured from the plumbago which was formerly worked to a large extent in the slates of Borrowdale in Cumberland. Plumbago mines have been opened in recent years in much more prolific parts of the world, and these not only supply the mineral for pencil-making, but also for many other purposes. Large quantities are exported from the Batougal Mountains in Southern Siberia, where pencil leads of a very high quality are obtained, best known under the name of the discoverer Alibert. In our Plate is represented an interior view of this famous mine. A considerable amount is also worked in Germany, Bohemia, and Styria. Extensive deposits also occur in America, and the Eureka Blacklead Mine at Sonora, in California, penetrates a deposit no less than 20 to 30 feet in thickness. Ceylon likewise furnishes large supplies of this useful mineral.

For other economic purposes plumbago is reduced first to a pulverulent condition. Its decidedly greasy feel renders it of use as a lubricating material, and, when carefully purified, it is often employed for polishing the coarser varieties of gunpowder. The object of the latter process is to varnish the particles, and thus prevent the absorption of moisture. A film of plumbago spread over the surface of iron checks the tendency to rust, and on this account the so-called blacklead is largely used both for household purposes and for machinery.

Plumbago powder is also employed for coating the moulds in electrotyping, and it is of great value to the metallurgist when manufactured into crucibles. In the latter case the finely-ground mineral is mixed with fire-clay and moulded, and then ignited in saggers in a pottery furnace; the crucibles thus made can be used in the melting of steel and other metals which require great heat for fusion.

PLUMB-LINE or **PLUMMET**. When a heavy body suspended by a flexible string is at rest, the line passing

through the point of suspension and the centre of gravity of the weight is in the direction in which gravity acts. The *horizon* is a plane perpendicular to this line, and the *zenith* is that point of the heavens marked out by the continuation of the line upwards. If the string be perfectly flexible it will coincide with the theoretical line above described. The plumb-line is used in the arts. In levelling and in astronomical instruments it has in most cases been superseded by the spirit level or by observations involving reflexion of light.

PLUME MOTH (Pterophoridae) is a small family of *MORPHO* remarkable for having their wings split up into a number of plumes, the membrane between the nervures being interrupted. There are several British species of these beautiful moths. The White Plume Moth (*Pterophorus pentadactylus*) is one of the prettiest insects known, with its long body, slender legs, and snowy white wings, the fore pair being split up into two plumes, and the hinder into three. It is common in gardens, flying in the twilight. The Stone-plume Moth (*Pterophorus lithodactylus*) is distinguished by the stone-gray colour of its wings. The Twenty-plume Moth (*Alucita polydactyla*) is a small brownish moth, with each of its wings split up into six plumes, which in repose are folded up like a fan. It is often found in outhouses. The caterpillar feeds in the buds of the honeysuckle.

PLUMULARIA. See *HYDROZOA*.

PLUMULE, in botany, is the name given to the first bud of a plant, the portion which takes an upward direction from the seed, and forms the primary stem.

PLUSH, a species of shaggy cloth or stuff with a velvet nap on one side, composed regularly of a woof of a single thread and a double warp; the one, wool of two threads twisted, the other, of goat's or camel's hair. Some plushes, however, are made wholly of worsted, others wholly of hair, while a plush of silk with a cotton backing is of considerable use for upholstery purposes.

PLUTARCH (Gr. *Ploutarchos*), like Homer and Æsop, is one of the few Greek writers who belong not more to Greece than to the world. If extensive and long-continued popularity is justly regarded as one of the best tests of some substantial excellence in an author, there is no ancient writer who can stand to be tried by this test more successfully than the author of the "Parallel Lives of Famous Greeks and Romans." This most popular of all Greek writers was a native of Chaironeia, a well-known town in the west of Boiotia, to the north of Mount Parnassos. The exact date of his birth, as of his death, is unknown, but it is certain that he was a young man when Nero visited Greece in A.D. 66, and that he flourished in the time of Trajan, A.D. 98–117, to whom his book of military and kingly aphorisms is dedicated, and under whom Suidas says that he held public appointments. He spent some time at Rome and elsewhere in Italy. His occupation in Italy indeed, both as a public functionary and as a teacher of philosophy, is distinctly witnessed by himself in the introduction to his life of Demosthenes, where he confesses that he knew the Romans better from a large experience of their affairs than from skill in their language. It was late in life before he began to busy himself with Roman literature. He seems to have retired latterly to Chaironeia, his native place—at least his life of Demosthenes was certainly written there; and, if we consider that he was twenty years old when Nero visited Greece, and that he lived out the reign of Trajan, he must have been at least seventy when he died.

The works of Plutarch fall naturally into two great classes—the well-known biographies, and the collection of moral and miscellaneous essays. The "Lives" have been indorsed by the approbation of centuries, and they will still stand the severest judgment of any critic who shall not insist on their being what they were never meant to be.

What Plutarch designed, as he himself in the preface to the life of Alexander has specially informed us, was not a curious record of connected historical events, but a characteristic portraiture of notable men. That he has attained this object in a style peculiarly attractive and effective is quite certain. The forty-six lives are arranged in pairs, one Greek, one Roman, and each pair is followed by a comparison of its two subjects. A few lives and parallels have been lost. It is sometimes thought, because of the ease and fascination of Plutarch's manner, that he is careless as to fact, but when brought to the test by accurate scholarship this is found not to be the case. To this we may add that if he is not always wise, he is at least generally wise; that the whole tone and temper of his writings is that which belongs to a healthy-minded, cheerful, unaffected, uncorrupted practical philosopher; and that in an age peculiarly tried by moral debasement, religious scepticism, and rhetorical conceit, he remained pure in heart, lofty in faith, mellow in wisdom, and natural in style. A master of the Greek language in the highest sense he certainly was not; but his occasional faults of style are nobly redeemed by the useful tendency and naturalness of his tone, and his entire freedom from those many vices of style that spring from the ambition of fine writing.

His "Moral Essays," though less read than his "Lives," are not less worthy of perusal. They are practical sound commentaries on actual life; lay sermons based upon the leading idea that the concrete exhibition of life is infinitely more valuable to living men than all speculations about life, and that all philosophy is vain which does not end in practical wisdom, of which wisdom the form is virtue and the inspiration love. The works of Plutarch were early translated into Latin, and obtained a wide circulation in that form before the Greek original was generally found on the shelves of scholars. The first Latin collection of the "Lives" was published at Rome in 1470, two vols. folio. The most celebrated translation is that of the Frenchman Amyot (1569), on which the famous quaint old English version of North, London (1612), is based. The best English translation is the accurate and elegant revision of Dryden's collection of versions, by Arthur H. Clough (London, 1859, three vols.); of the "Moral Essays" there is a good old English translation by Holland. The best Greek editions of the "Lives" are Reiske (Leipzig, 1714), and Hutton (Tübingen, 1791); of the "Moralia," by Wyttienbach (Oxford, eight vols. 1795–1821).

PLUTO (Gr. *Plouton*), more frequently called by the Greeks *Hadēs*, or rather *Aidēs* and *Aidoneus*, and by the Romans *Orcus* and *Dis*, was the brother of Zeus and Poseidōn. He presided over the region beneath the earth, where the departed souls, or rather the shades of men, were placed. He is represented by the ancient writers as a gloomy deity, inexorable to the prayers of mortals, and hated by the human race above all the gods. His wife was Persephonē, called by the Romans Proserpina, whom he stole from her mother, Dēmētēr. In later writers the word Hades signifies the abode of the dead, as well as the deity who presided over it. The word Hades is derived by some writers from Gr. *a*, not, and *idein*, to see, referring to the god's invisibility at will. Ploutōn (Pluto) is from Gr. *ploutēs*, to be rich, and indicates the mineral wealth of the earth, which the god was supposed to have at his command.

PLUTONIC ROCKS (so called from Pluto, the mythical god of the lower regions) are those igneous strata which have consolidated at great depths beneath the earth's surface. They are completely crystalline, such as GRANITE and DIORITE, and were grouped under this general term by the older geologists to distinguish them from the VOLCANIC ROCKS which have solidified at or near the surface, and do not consist wholly of crystalline grains.

PLUTONIST, a party term of a long-extinct geological controversy. See *VULCANIST*.

PLUTUS (Gr. *Ploutos*), the god of wealth, is said by Hesiod to have been the son of Dêmêtêr and the hero Iasion. He appears as a character in the comedy of Aristophanes named after him, but we have no particulars respecting his worship. Zeus is said to have blinded him lest he should discover favourites among men and heap riches upon them: as it is, unable to see, he scatters his gifts at random, quite irrespective of desert or merit.

PLUVIOMETER. See RAIN-GAUGE.

PLUVIUS, god of rain, usually an attribute of Jupiter rather than a separate divinity. The Roman prayers for rain were always addressed to Jupiter Pluvius.

PLYMOUTH (pron. *Plim'uth*), a seaport and parliamentary and municipal borough in the S.W. of Devonshire, 192 miles in a direct line W.S.W. from London, and 247 miles by railway through Bristol and Exeter. The town is situated on the north side of the bay called Plymouth Sound, between its two great arms, the Catwater on the east and the Hamoaze on the west. The bays and inlets all around and within the sound and the Hamoaze are so numerous as to afford unusual facilities for the construction of works connected with shipbuilding, fortifications, naval defences, and maritime commerce. The ancient parts of the town are irregularly laid out, and many of the streets are narrow, steep, and ill-built. Plymouth possesses the finest pile of municipal buildings in the West of England, and one of the most important structural developments of civic life that has been erected in this country during the present century. After being four years in building the Guildhall was opened by the Prince of Wales, who is Lord High Steward of the borough, in 1874. The buildings are in two blocks, so arranged as to form, with the church of St. Andrew, three sides of a spacious quadrangle. The north block contains the council chamber and the municipal offices. In the south block is the great hall and the law courts, and at its south-west corner rises the great tower to a height of nearly 200 feet. There is a good deal of carving—armorial and other—on the exterior of the buildings. The great hall is an exceedingly handsome room, 145 feet long by 85 feet wide. The buildings are adorned with numerous painted windows and statues, commemorative of the most remarkable persons and events connected with the town. Among the other institutions are a post-office, market, Household of Faith, Freemasons' Hall, public library, mechanics' institute, exchange, custom-house, public baths, an hospital, eye infirmary, and orphan asylum. The principal church is that of St. Andrew, erected chiefly about 1430, in which the heart of the great admiral, Robert Blake, was interred. There are various other churches, places of worship for every denomination of dissenters, and a handsome Roman Catholic cathedral. The town also contains the Western Congregational College. The grammar-school, in which Sir Joshua Reynolds was educated, is well endowed, and there are several other good educational establishments. Near the town is a handsome cemetery. Plymouth is supplied with excellent water from Dartmoor, 30 miles distant. This important benefit is due to Sir Francis Drake, who was a native of the county. In the suburb of Stonehouse are St. George's Hall, one of the handsomest in the west of England; the Royal Western Yacht Club House; the beautiful winter villa of the Earl of Mount Edgumbe; the Royal William Victualling Yard, extending over 14 acres, with a sea-wall 1500 feet long; the Naval Hospital, admirably arranged, and able to accommodate 1000 patients; and the Royal Marine Barracks, for 1200 men.

The Hoe (Saxon, high ground) is one of the finest promenades in the kingdom. Part of it has been planted with ornamental shrubs, and it has carriage-drives, walks, and seats. It commands a most beautiful view of the Sound and the Channel, as well as the surrounding country, including Mount Edgumbe, with the Cornish hills in the west and the high land of Dartmoor in the north. A

statue of Drake, placed on the Hoe in 1884, and the upper part of Smenton's Eddystone Lighthouse, are striking objects. The Hoe is especially interesting for the well-known scene of Drake and the other English captains playing a game of bowls there, when the news came that the Armada was seen in the offing. Adjacent to Plymouth Hoe is the Citadel, an old fortress, but still valuable in connection with the enlarged circuit of modern fortifications.

Plymouth has been for a long period the second naval station of Great Britain. The dockyard at DEVONPORT, commenced in the reign of William III., is one of the finest establishments of the kind in Europe. The harbour of Plymouth is double, being formed by the estuaries of the Plym and the Tamar, opening into the north-east and north-west angles of the Sound. The estuary of the Plym forms the Catwater, a convenient and capacious harbour for merchant vessels; and that of the Tamar expands into the noble harbour of Hamoaze, nearly 4 miles in length by about half a mile in width: it is almost completely landlocked, and everywhere has good anchoring ground; its average depth is 9 fathoms at low water, and the largest ships float close to the quays. Subordinate to the harbour of Catwater is Sutton Pool, a small tidal basin to the east of the citadel, surrounded by quays for the convenience of colliers, coasting vessels, and fishing smacks, by which it is almost exclusively frequented. In Mill Bay a pier has been constructed, by means of which the largest steamers are enabled to come alongside at all times of the tide. There are also some magnificent docks (the Great Western), which have a depth of 22 feet, and cover an area of 14 acres. The bay or arm of the sea called Plymouth Sound, into which these harbours open, is used for the accommodation of the ships that have been refitted in the dockyards, and as a safe asylum for vessels of all kinds in stormy weather. Owing, however, to a heavy swell from the south, it was formerly very unsafe for anchoring, and to obviate this a stupendous breakwater was formed in the middle of the Sound. It was commenced in 1812, and has a total length of 1700 yards. The material of which it is constructed is of rough cubical blocks of stone, each weighing from 1½ to 2 tons and upwards. The top presents a flat surface about 15 yards in width, whence it slopes on both sides to the bottom. Its erection cost £1,500,000, and its efficiency as a protection to the harbour has been proved in the severest gales. A lighthouse, visible at a distance of 8 miles, is erected at its western extremity. The celebrated EDDYSTONE Lighthouse is about 14 miles south-west of the breakwater, and is an important appendage to the harbour, the entrance to which would otherwise be comparatively dangerous, in consequence of the hidden rocks on which the lighthouse is placed.

The principal articles manufactured in the town are soap, rope, canvas, Roman cement, British spirits, starch, and pottery. There are also steam saw-mills, iron works, and extensive establishments for shipbuilding, ironfounding, and brewing. The trade of Plymouth is very important, its foreign commerce being chiefly with the West Indies, the Baltic, the Mediterranean, and the Cape of Good Hope. The imports consist mainly of timber, fruits, corn, wine, &c.; the principal exports are manganese, lead ores, coffee, fish, granite, clay, limestone, &c. There is also a very large coasting trade. The town is well supplied with railway accommodation, and steamers ply between London, Dublin, Southampton, and Jersey. Plymouth is also a port of call for steamers from the West Indies and to and from the Cape of Good Hope, and for many vessels engaged in the Australian trade. The number of vessels registered as belonging to the port in 1886 was 380 (32,000 tons). The entries and clearances average 3500 (800,000 tons) per annum.

Granite, slate, limestone, and an inferior kind of marble are quarried in the neighbourhood. There is also an active

fishery, especially of whiting and hake. In 1834 a floating stean-bridge was established across the Hamoaze, between Devonport and Torpoint, which for many years conveyed carriages, horses, and passengers; but this is now superseded by the splendid railway bridge, known as Brunel's Albert Bridge, which unites the counties of Devon and Cornwall. It is constructed of two spans of 455 feet each, and stands 90 feet above high-water mark.

The municipal borough of Plymouth is divided into six wards, and is governed by a mayor, twelve aldermen, and thirty-six councillors. The parliamentary borough returns two members. The parliamentary and municipal limits were identical till 1868, when the former were slightly extended, and in 1881 the respective populations were 76,080 and 78,794. Plymouth, Devonport, and Stonehouse now virtually form one great city, with nearly 150,000 inhabitants. Plymouth is the largest, its population being nearly equal to that of both the other two; and it claims from antiquity a fair degree of historical renown, whereas Stonehouse and Devonport are of comparatively modern date.

Plymouth by the Saxons was called Tameorworth, from its position on the Tamar; by the Normans, Sutton or South Town, and in the reign of Henry VI. it obtained its present appellation. In its early history it belonged to the priory of Plympton, and markets and fairs were established by the prior. As early as 1295 a fleet sailed hence for Guienne. In 1330 it was partially burned by the French, who landed here again in 1350 and destroyed some farms. In 1355 Edward the Black Prince sailed from this port to France prior to the battle of Poitiers, and afterwards landed here with his royal prisoners, King John and the Dauphin. In the reign of Edward II. it was fortified. In 1400 the French destroyed a considerable part of the town, and at other times it suffered from incursions of the same enemy. In the fifteenth century the fortifications were strengthened, and walls were built for the defence of the town. During the wars of the Commonwealth it was held by the Parliamentary party, although repeated attempts were made by the Royalists to take it. It had already become the godmother, if not the parent, of a namesake Puritan town in Massachusetts. New Plymouth, the first settlement in Boston Bay, had been founded by the emigrant Pilgrim Fathers, chiefly natives of Lincolnshire, who sailed in the *Mayflower*.

About 5 miles east of Plymouth is Plympton, a small half-rural place, but with a ruined Norman castle, which bore its part in the wars of the Empress Matilda against King Stephen; and with the remains of a grand priory, which enjoyed great wealth till the dissolution of the monasteries by Henry VIII. The old grammar school of Plympton is notable as the birthplace of Sir Joshua Reynolds, whose father was schoolmaster here; and there is a good collection of his paintings in Saltram House.

PLYMOUTH SOUND, an important naval station and roadstead on the coast of Devon, about 8 miles long north to south, and 2 miles wide. There is safe and ample accommodation in the Sound for 2000 vessels, with a depth of from 5 to 12 fathoms at low tide. It has bold shores, composed of sandstone and limestone of the old red formation. Opening S.S.W. to a heavy swell of the sea with southerly winds, it was a very unsafe anchorage, till the construction of the celebrated breakwater, completed in 1845, making it one of the finest and most secure havens in the kingdom. St. Nicholas or Drake's Island lies in the middle. It is 8 acres in extent, and is occupied by fortifications and barracks.

PLYMOUTH, a town of Massachusetts, in the United States, situated on a bay of the same name, 32 miles S.S.E. of Boston. Though the oldest town of the States it has not a single building of any antiquity. There are several churches, and iron, woollen, and cotton factories, and the

fisheries are extensive. The most remarkable building is the Pilgrims' Hall, a granite structure, 70 feet by 40, with Doric portico, erected 1824-25, by a society founded 1820. It contains a cabinet of curiosities and some historical paintings, and commemorates the first most important event in American history—the landing of the Pilgrim Fathers from the little *Mayflower*, 50 tons burden, 22nd December, 1620. On Forefathers Rock, still carefully preserved, 101 persons disembarked, and a magnificent national monument to the Fathers has been erected on it. The population in 1880 was 7093.

PLYMOUTH BRETHREN are a sect of Christians who owe their specific or local designation to the circumstance that they first emerged into observation at Plymouth, about the year 1830. Their principal founder was the Rev. J. N. Darby, a gentleman who had originally been a barrister, but who, under deeply religious impressions, became a curate in the Episcopalian Church of Ireland. In 1827 he retired from the church and associated himself with a few devout people in Dublin who had formed a little independent religious society, calling themselves simply The Brethren. In 1830 he was at Plymouth, where his preaching attracted much attention, and he was joined by a large number of converts, mostly Christian people drawn from other churches, among whom were the Rev. Benjamin Wills Newton, the Rev. James L. Harris, and the well-known Biblical scholar, Dr. Samuel Prideaux Tregelles. Under the editorship of Harris a newspaper was started with the title of *The Christian Witness*, Darby being the most important contributor. During the next few years the sect made rapid progress, and established itself in most of the large towns of Great Britain, and in 1838 it was introduced to the Continent by Darby, who established himself in French Switzerland and commenced a work among the Protestants. His success on the Continent was as great as it had been in England, and congregations of the new society were formed in Geneva, Lausanne, and at Vevey, while his teachings found their way into German Switzerland, Germany, Italy, and France. In 1845 he returned to England, and soon afterwards the first great division in the body occurred, Darby setting up a rival congregation at Plymouth in opposition to Newton, whom he accused of heresy and of a desire to reintroduce the spirit of clericalism. Part of the brethren sided with Newton and part with Darby, and in 1848 another division took place owing to the action taken by the congregation at Bristol, in which the philanthropist Mr. George Müller was the most influential member. The majority of the brethren, however, remained faithful to the leadership of Darby, and refused to hold communion with the followers of Newton or Müller; but in the course of a few years further divisions ensued, and at the present time the society is broken up into at least five separate sects or parties, who may be distinguished as (1) the followers of Mr. Darby; (2) those who accept the teachings of Mr. Newton; (3) the Neutrals, headed by Mr. Geo. Müller; (4) the adherents of Mr. William Kelly; and (5) the followers of Mr. Pearsall Smith.

Among themselves, the members of these societies reject the appellation Plymouth Brethren together with those we have used to designate the chief divisions, calling themselves simply Brethren. At the outset they started with an ultra-Calvinistic system of theology, to which in the main they still adhere, but their distinctive doctrines are rather ecclesiastical than theological. They follow the Quakers in rejecting an official ministry, insisting very strongly upon the spiritual priesthood of all believers, and their meetings resemble those of the Quakers in that any member who feels disposed is free to exhort, admonish, lead in prayer, &c., frequent pauses being made in expectation of the motion or prompting of the Holy Spirit. They consider that all the existing ecclesiastical organizations, whether

Episcopal, Presbyterian, or Independent, have gone astray in respect to the appointment of a clergy, insisting that it is not the pleasure of a preacher, nor of a synod of preachers, nor of a congregation, nor of a sect, nor of the church itself, much less of any worldly power, which ordains a minister. It is the Spirit of God dividing to every man severally as he will. They differ, however, from the Quakers in recognizing baptism and the Lord's Supper as permanent institutions, and they are accustomed to meet every Sunday morning for the "breaking of bread," though the ceremony is in no way regarded as a sacrament. They regard the Bible as being an infallible and fully inspired revelation from God, pressing the doctrine of verbal inspiration much further than the majority of Protestants, and they consider that every real disciple finds the true meaning of the word opened up to his mind by the ever-present Holy Spirit. The prophetic books of both Testaments have received much study from the leaders of the society, and most of the members are strong millenarians. Plymouth Brethren usually refuse to mingle in municipal or parliamentary elections, basing their abstention upon certain Scripture texts.

See for a further account of the sect Darby's "Collected Works," in thirty-two vols.; Müller's "The Brethren, their Rise, Progress, and Testimony" (1879); Teulon's "History and Doctrines of the Plymouth Brethren" (1883); Reid's "History and Literature of the so-called Plymouth Brethren" (second edition, 1876); and "Plymouth Brethrenism Unveiled and Refuted," by the same author (third edition, 1880).

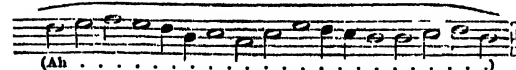
PNEUMA (Gr. *pneuma*, Lat. *neuma*, lit. a breathing). The word *pneuma* is used in ecclesiastical music in a different sense from *neuma*, though both words are etymologically the same. *Neuma* means a sign for a group of notes as distinct from *punctus*, a "point" denoting a single sound (our modern music-notes are all "points," and the word itself is preserved in the term "counterpoint"); and the subject of *neumæ* is treated of under the English equivalent of *NEUMATA*. *Pneuma*, on the other hand, means a long passage in one breath, a kind of cadence, sung very legato, either as a variation on a syllable, of the text or to the syllable *la* or the vowel *ah* (as in *further*) following an antiphon or other melody by way of a flourish or ornament. The *pneumata* in the Greek Church ritual are very elaborate. Their use is very ancient, dating from before the separation of the churches. The following are specimens from the Plain-song of the Roman Catholic Church, set in modern notation:—



1. *Pneuma* on a syllable of the text (Compline Office, Holy Sunday).



(*Pneuma.*)



2. *Pneuma* following Alleluia of the Gradual (Tone 1), Easter Day.

PNEUMATIC DESPATCH RAILWAY and **PNEUMATIC TUBES.** After the introduction of rail-

ways stationary steam-engines were used on some lines called *Atmospheric*, to exhaust air from a tube lying between the rails, containing a piston to which the train was attached, so as to be dragged by the atmospheric pressure, but that mode of propulsion was afterwards abandoned. An improved application of a similar principle appears in the *Pneumatic Despatch Railway*, in which the entire carriage or train of carriages is driven through a tube or tunnel of sufficient size by a blast of air produced by a suitable blowing apparatus, which works by forcing or by exhaustion, according as the train is to be propelled from it or towards it. The Electric and International Telegraph Company first introduced the pneumatic system of transmission into London. Iron tubes were laid from the central to the branch stations, and bundles of messages for distribution from the latter were inclosed in a suitable case and driven through the tubes by a current of air. When there was any accumulation of messages they were thus delivered at the branch stations without the delay and chance of mutilation which would have resulted from each one being sent through the wires. Since the government undertook the telegraphs there has been an enormous development of business, and the pneumatic despatch tubes are consequently now an invaluable accessory of the General Post-office. Altogether there are thirty-three tubes which come in from the outside to the great central hall on the ground floor of the General Post-office. The tubes, which are composed of lead, run in all directions in the E.C. and W.C. districts; and the stations therein are connected by a double tube, which forms a complete circuit and has a column of air always passing through it, and which is moved either by pressure or by vacuum, or by both. The diameter of the tube is 8 inches. The double tube may be compared to a pneumatic railway, having an "up" and "down" line, and being worked on the railway block system, for which purpose it is fitted with a patent train-signalling apparatus. The up and down lines may be opened through their entire length, or may be blocked by switch boxes at an intermediate station. The terminal stations can send carriers to be stopped by the switch box at an intermediate station; and the intermediate station, when it knows a through carrier to be coming for one of the termini, can, if it happen to have any messages of its own for that terminus, switch out the through carrier, insert its own messages, and send on the carrier again without appreciable delay. The tube being of large size, the carriers are proportionately large, and each will hold about fifty messages. When pressure and vacuum are employed the distance between the General Post-office and Charing Cross is traversed in about four minutes; when vacuum alone is employed about five minutes are required for the transmission. When the tube is working within its power it is able to do the work that would fully occupy six wires and twelve clerks. The pneumatic tube system has also been extended to some of the larger provincial towns, such as Liverpool, Manchester, Birmingham, Glasgow, and Dublin.

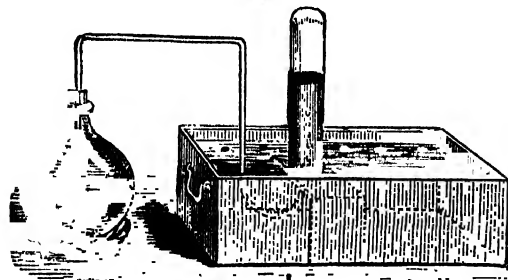
PNEUMATIC LEVER, PNEUMATIC TUBULAR TRANSMISSION OF ENERGY. See ORGAN.

PNEUMATIC TROUGH, a useful appliance used by the chemist to collect gases over water. It was invented by the ingenious Dr. Priestley, and is exceedingly simple in design. If we fill a tumbler and invert it in a bowl of water, we may raise it up until the mouth is almost upon a level with the surface. The pressure of the atmosphere upon the surface of water in the bowl, hinders that in the tumbler from descending. If we now blow air through a pipe into the water, it will ascend to the surface in bubbles; and if our pipe is blown under the inverted tumbler, the bubbles will rise within the glass, and gradually displace the water by driving it out of the tumbler.

This simple arrangement, modified in shape, but involving no new principle, is the pneumatic trough represented

in fig. 1. It is generally an oblong box of japanned sheet-iron or copper, or simply of wood made water-tight, varying in size according to the size of the receivers to be employed. There is a movable shelf, upon which the gas jars stand, with their mouths below the surface; and which is pierced with apertures, to allow the ascent of the gas bubbles from the beaks of retorts, &c., into the jars. The method of using the trough is as follows:—Water is poured

Fig. 1



in until it stands about an inch above the shelf. The jars or receivers are then filled with water, and placed upon the shelf with their mouths downward. Directly underneath is placed the delivering tube of the vessel in which the gas is generated. This may be either a retort, or a flask or bottle fitted up with bent tubes.

Whatever apparatus we use in generating gases, the first portion that passes over will be impure, being mixed with the air contained in the vessel. It should, therefore, be allowed to escape, or collected in a separate receiver. Hydrogen, olefiant gas, and a few others, when thus mingled with common air, are dangerously explosive.

As soon as a receiver is full, it may be removed from the shelf, and, by inserting a saucer beneath the mouth of the jar, without raising the latter above the surface, may be transferred altogether from the trough, and set aside for use. It must be remembered, however, that gases cannot thus be preserved for an indefinite length of time. The water by which they are confined secures them indeed from direct contact with the atmosphere, but by alternately absorbing, and again evolving, at every slight change of temperature, small portions, both of the outer air and of the

wards, and below the surface. The vessel containing the gas is then brought up to it, and gradually inclined with its mouth below the aperture of the other vessel, so that the bubbles of gas may ascend into the latter. In the appended sketch (fig. 2), *a* represents the receiving, *b* the delivering jar, and *c c* the water level. If the receiving vessel be very narrow, a funnel must be used, as at *d*.

Certain gases, however, such as ammonia, hydrochloric acid, and cyanogen, are either decomposed or absorbed by water. Such gases are collected over mercury. The mercurial trough is made of iron or stoneware, and, on account of the weight and expense of the material, is usually of small size. On account of the great pressure, much care is required in securing all the joints of the gas-generating apparatus, and the extremity of the delivering tube must be brought exactly under the mouth of the receiving jar. Chlorine gas, which attacks mercury, is collected either over warm water or by displacement, the delivering tube being conducted to the bottom of a tall dry jar.

Water should not be allowed to remain standing in the pneumatic trough longer than absolutely necessary, especially if gases of an acid quality have been collected. For the purpose of letting it off, it is very convenient if a tap be inserted at the bottom.

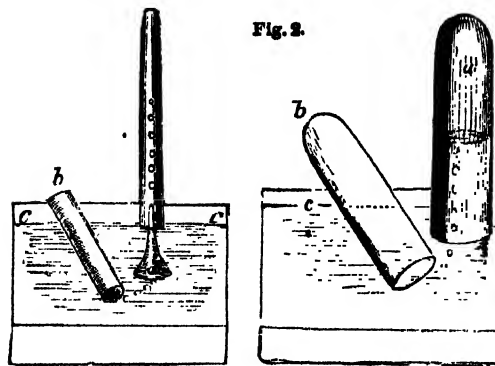
PNEUMATICS. This name is given to that subsection of physical science which treats of the mechanical properties of elastic fluids, and especially of common air. The word is derived from the Greek *pneuma*, breath or spirit. The first property observable in gases is that they tend to fill the entire space open to them, a fact which causes them to be specially distinguished as the elastic fluids. If the space is restricted, they exert pressure against its walls in their tendency to expand; and the smaller the space, and the denser therefore the gas, the greater the pressure.

All gases and vapours expand under a constant pressure when heated from 32° to 212° Fahr., by about $\frac{1}{480}$ of their volume, which gives an expansion of $\frac{1}{480}$ for each degree Fahrenheit; hence the volume of a gas, measured at any given temperature, may be reduced to the volume which it would have at any other temperature. The expansion of atmospheric air, when heated from 32° to 212° Fahr., is constantly the same, whether under a pressure of $\frac{1}{16}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1, 2, 3, 6, or 15 atmospheres. Air heated from 212° Fahr. to low redness expands from one measure to 2.25, and at a bright red heat to more than 2.50 measures.

The simple experiment of pouring mercury into a bent tube, open at one end and closed at the other, by which the air in the closed part becomes reduced in volume, having shown that the volumes of the condensed air vary inversely as the weights of the mercury and the atmosphere by which the compression is produced, it follows that the densities are directly proportional to the compressing weights; also, since these are balanced by the elastic power of the condensed air, it seems to follow that the elastic force is also directly proportional to the compressing force, i.e. to the density. This is the law of Boyle and Mariotte, which, although not absolutely correct, is near enough to the truth to be very generally employed. The law being admitted, it may be easily proved that the particles of an elastic fluid repel each other with a force which varies inversely as the distance between them. Newton, however, observes ("Princip., lib. ii., prop. 23, schol.) that this law holds good only when the repulsive power of any particle does not extend much beyond those which are nearest to it.

Since the volume of an elastic fluid increases proportionally as the temperature, it follows that the density of an elastic fluid varies directly as the compressing force, and inversely as the temperature.

Fig. 2.



gas within, an interchange is gradually effected, and the receiver will ultimately be found to contain very little of the original gas.

It is often necessary to transfer portions of gas from one receiver to another, or to a tube. For this purpose, the vessel into which the gas is to be led is filled with water, and held in a perpendicular position, with its mouth down-

Considerable difficulty is found in determining the specific gravities of gases with precision, and different experimenters have obtained results which do not exactly agree. That of air being assumed to be $=1$, we find—Oxygen, 1.1056; hydrogen, 0.0692; steam, 0.6235; carbonic oxide, 0.9569; carbonic acid, 1.5290; sulphurous acid, 2.1930; chlorine, 2.4216; ammonia, 0.5967.

Air, when the mercury stands at 30 inches of the barometer, and the temperature is 55° Fahr., weighs 534 grains troy, or about $1\frac{1}{2}$ ounce per cubic foot; and the experiments of Dalton have led to the conclusion that the weight of a cubic foot of steam when at the temperature of boiling water, and the barometer standing at 30 inches, is 253 grains troy. Air is 773 times lighter than water under the given circumstances.

From experiments it has been concluded that while steam is in contact with the water from which it is formed, its expansive force increases in a geometrical progression, while its temperature is at the same time increased in an arithmetical progression; but the relation between the elastic force of this gas and its temperature, in that state, is as yet far from being certainly known. The following table, obtained by Regnault's apparatus, shows the tension of the vapour of water at high temperatures. The second column shows the force measured by multiples of the weight of the atmospheric column when the barometer stands at 30 inches:—

Temperature.	Atmospheres.	Temperature.	Atmospheres.
212° Fahr. . .	1	328° Fahr. . .	8.036
250 " . . .	2.025	344 " . . .	9.929
261 " . . .	3.008	390 " . . .	15.062
279 " . . .	4	437 " . . .	25.125
294 " . . .	4.971	462 " . . .	27.534
306 " . . .	5.966		

When steam is not in contact with the water from which it is formed, and when it is subject to a constant pressure under which it may expand in every direction (as when it is formed in the atmosphere), an increase of temperature will not produce an increase of density, but merely of elastic power. But if the steam is incapable of changing its volume, as when it is contained in a close vessel, the elastic force increases by an increase of temperature in the same proportion as the volume would have increased under a constant pressure; whence it may be shown that, if t denote any given temperature in the last table, and F the compressing force corresponding to that temperature, the specific gravity, or weight in grains, of a cubic foot of steam at the given temperature, and under the given pressure, will be obtained from the formula

$$\frac{254.7 F}{20.52 + 0.47 t}$$

The expansive force of fired gunpowder has been found to be above 2000 times as great as the pressure of the atmosphere in its ordinary state.

It may be easily shown, the temperature of the atmosphere and the force of gravity being supposed constant, that if a vertical column of the atmosphere were divided into concentric strata of small and equal heights, the densities of the air in those strata, from any point downwards, would increase in a geometrical progression, while the distances of the strata from the same point would form an increasing arithmetical progression; and on this circumstance is founded the approximative formula for determining the heights of mountains by the barometer. [See HEIGHTS, MEASUREMENT OF.] In the article which has just been referred to, is an account of another means of height measurement by the pressure of the air, based on the following fact:—Water boils when the elastic power of the vapour formed from it is equal to the incumbent pressure; and consequently the temperature at

which the boiling takes place in the open air will depend upon the weight of the atmospherical column above it. On this principle the Rev. Mr. Wollaston constructed an instrument called a thermometrical barometer, by which the relative heights of stations can be found. A tube containing the mercury is provided with a graduated scale, and, when used, the bulb is placed in a vessel of water, which is made to boil by means of a spirit-lamp.

The specific heats of several gases (at constant volume or at constant pressure) have been obtained by Regnault. That of dry air is 0.2375, water being 1. The following curious results are observed; first, that the specific heat (which is the ratio of the varying quantities of heat necessary to raise, 1, a pound of water, and, 2, a pound of the other substance compared with water, one degree of the thermometer) remains the same at all pressures, or in other words, the thermal capacity per unit of volume is directly as the density. Secondly, the specific heats of different gases vary (very nearly) inversely as their densities. Combining the two results we get a third, that all gases (or nearly all) have for practical purposes the same thermal capacity per unit of volume at the same pressure and temperature. Fourthly, if equal quantities of heat be successively added to a gas kept at constant volume, the pressure of that gas will increase in arithmetical progression. It is found, further, that the specific heats of gases have relation to their atomic weights; so that a product of the two is approximately constant, or in other words, the specific heat varies inversely as the atomic weight. The higher the temperature the more nearly is this true.

Certain special cases of pneumatics depending on the pressure of the air are dealt with in the articles HYDRAULICS (*Pumps*), BALLOON, BAROMETER, BOILING OF LIQUIDS, AIR-PUMP.

The velocity with which air, steam, or any other elastic fluid, flows into a vacuum through an aperture in a vessel follows the same law as water or any other non-elastic fluid; for though the quantity of fluid passing through the orifice in a given time varies with the density of that which successively comes to the orifice, yet the pressure by which it is forced out varying in the same proportion, the velocity, by dynamics, remains constant. A column of air in its ordinary state, extending to the top of the atmosphere, rushes through an orifice into a vacuum with a velocity ($=1389$ feet in a second) equal to that which a heavy body would acquire in falling through a height equal to that of a homogeneous atmosphere. Thus, also, knowing the temperature of steam, and consequently its elasticity, or the equivalent pressure, we can find the height of a homogeneous atmosphere which would produce the same pressure; and then the velocity with which the steam flows into a vacuum would be equal to that acquired by a body in falling down the height of such atmosphere. But if the steam is to flow into any elastic fluid of less density than itself, the height of the homogeneous atmosphere must correspond to the difference of the pressures arising from the different elasticities of the two fluids.

The time during which air, in the ordinary state, must flow through an orifice into an exhausted vessel before the air in the latter acquires any given density, D' , is expressed by the formula

$$\frac{2V}{A\sqrt{2gh}} \frac{D(D-D')^{\frac{1}{2}} + D^{\frac{1}{2}}}{D}$$

in which V is the interior volume of the vessel, A the area of the orifice, D the ordinary density of the air, g the force of gravity (32.2 feet), and h the height of a homogeneous atmosphere.

The density of the air in the receiver of an air-pump, after n strokes of the piston, is expressed by

$$D \left(\frac{r^n}{r^n + c^n} \right)^{\frac{1}{n}}$$

in which D is the density of the air in the receiver when the process of exhaustion commences, v the volume of the receiver, and v' that of the barrel.

PNYX (Gr. *pnux*), the place of public assembly in Athens. It was a semicircular hill, south-west of the Areopagus, with an area of 12,000 square yards, surrounded by a wall. On the paved floor at its base stood the *bema* or platform whence the orators addressed the people, seated in rising rows along the hillside. The assembly thus held in the open air was closed by any change in the weather, as we know from the passage in the "Acharnians" of Aristophanes (the scene of which comedy is laid in the Pnyx), where Dikaiopolis enforces the closure because he alleges he feels a drop of rain.

PO, a river of Italy, called *Pandus* and *Eridanus* by the Romans, rises from two springs, in about $44^{\circ} 40'$ north lat., 7° east lon., on the eastern side of Monte Viso, a splendid mountain pyramid 12,580 feet high, the upper part of which is covered with perpetual snow. The sources of the river are about 6000 feet above the level of the sea, and it flows, in a direction generally eastwards, through or near the towns of Carignano, Turin, Chiavasso, Casale, Valenza, Piacenza, Cremona, Guastalla, and Ferrara. The tributaries which it receives on the north or left bank are—the Chisone, Dora, Ripaira, Stura, Orca, Dora Baltea, Sesia, Agogna, Terdoppio, Ticino, Lambro, Adda, Oglio, Mincio, Bianco, Polesella, Tartaro, and Adige: these are named in their order from west to east. On its south or right bank it receives the Vraita, Maira, Grana, Tanaro, Scrivia, Bornida, Trebbia, Nura, Taro, Parma, Enza, Crostola, Soelcio, and Panaro. The most important of these, in respect to length and the towns passed through, are the Ticino, Mincio, Tanaro, and Trebbia.

About 5 miles north from Ferrara the Po divides into two branches, and enters the sea by several mouths, the principal of which are always navigable. The length of course from the point of bifurcation to the mouth is about 20 miles. The tide is only felt in a slight degree about 7 or 8 miles above the mouths, and it does not rise quite 2 feet. The whole course of the river, including its windings, is reckoned at about 400 miles, for nearly 300 of which it is navigable for barges and river steamers. It abounds with sturgeons, salmon, and other fish, and is highly useful in fertilizing the surrounding country.

The width of the bed of the Po, from the confluence of the Ticino to its bifurcation, is from 1200 to 2000 feet. The depth of water varies from 12 to 36 feet. The periodical floods take place in the summer months, in consequence of the melting of the snows in the Alps, but extraordinary floods occur at other seasons also after great rains. From Piacenza to the sea it is inclosed by embankments, to protect the country from inundations. These embankments are carefully kept up, and in consequence of this the quantity of earthy matter brought down by the Po, and the rapidity of the formation of land at its mouth are greatly increased. Towns that were formerly on the sea are now quite inland—Adria (which was once an important port, and gave its name to the Adriatic Sea) and Ravenna, for instance. The land has gained on the Adriatic at times, at the rate of about 230 feet annually. The basin of the Po covers an area of about 27,000 square miles.

POA is a genus of GRASSES belonging to the tribe Poaceæ. The inflorescence is in spreading or close panicles; the spikelets contain several flowers, the imperfect ones being above the fertile ones. This is a very large genus, with a very wide distribution. Some of the British species are valuable agricultural grasses, especially *Poa pratensis* (the common meadow-grass), which is found in most pastures, and *Poa trivialis*, which grows in moist and shady places. *Poa annua* is a little annual grass which springs up everywhere, flowering and ripening its seeds at all seasons when not actually frozen. Some of the British

species are only found on the tops of the highest mountains, while others form the pasture grasses on salt marshes by the sea-shore.

POACHING. See GAME LAWS.

POCAHONTAS, daughter of Powhattan, an Indian chief of Virginia, was born about 1595. She is renowned in history for her generous heroism in saving the life of Captain John Smith, the leader of an English colony, and rushing between him and the savage whom her father had selected to be his executioner. She afterwards frequently visited Jamestown, the English settlement, but was eventually seized as a hostage, and married to Captain John Rolfe, in 1613, after being baptized by the name of Rebecca. She was then brought to England, in 1616, and presented at court, but accidentally meeting with Smith, whom she had been led to believe was dead, she fell into a fit of melancholy, and died at Gravesend in the following year, after giving birth to a son, from whom have descended the Randolphs and other Virginian families. The entire story of her connection with Smith is now regarded as a fiction, due to the vanity of Smith himself.

POCHARD (*Fuligula ferina*) is a species of ducks belonging to the subfamily FULIGULINÆ or Sea Ducks. The genus *Fuligula*, of which this is the typical species, is distinguished by having the bill long, flat, and broad, and slightly dilated at the tip, and the wings and tail short. The pochard, the female of which is known as the dunbird, is a frequent winter visitor to Britain, and of late years has been known to breed in several places in the north. It is abundant in the northern regions of both hemispheres, migrating in winter as far south as Carolina and Louisiana, and, in the Old World, Barbary and Egypt. In winter it frequents the sea-coasts, but retreats inland in the summer to breed. The pochard measures nearly 20 inches in length. The head and neck are chestnut-red, the lower part of the neck and the breast deep black, the sides and flanks freckled with delicate gray spots and lines upon a white ground, the tail-coverts black, and the lower surface dull white. The female or dunbird has much the same plumage as her mate, except that the back and upper tail-coverts are dull brown, and the lower tail-coverts brownish-gray. In both the eye is red. The flesh of those birds shot in fresh waters is very good, but birds killed on the sea-shore are coarse and ill-flavoured.

The celebrated Canvas-back Duck (*Fuligula vallisneriana*) of North America is nearly allied to the pochard. It is a much larger bird, with a longer, higher, and narrower bill; the head is darker and the back and flanks are lighter, the black lines being broken up so to present the appearance from which the common name is derived. In fresh waters it feeds on the Vallisneria, an aquatic plant with long, narrow grass-like leaves, and from this food it is supposed to acquire the delicate flavour for which it is so famed. The canvas-back is a very shy bird, and most difficult to be approached.

POCHETTE (Fr. for pocket), a small instrument of the violin kind, but with a neck much longer in proportion to the body than that of the violin. The body is often boat-shaped. The name is derived from the instrument being small enough to be carried in the pocket. The "kit" of the old-fashioned dancing-master, now almost obsolete, was a violin-like variety of the pochette.

PODARGUS is a genus of birds classed with the GOAT-SUCKERS (Caprimulgidæ), but sufficiently distinct to form a subfamily. There are about ten species peculiar to the Australian region. They are all of large size, and are distinguished from the true goatsuckers by the much greater strength of the bill. The head is large and the gape enormously wide. The wings are short, and the feet stout; the outer toe is to a certain extent reversible.

The Tawny-shouldered Podargus (*Podargus striginides*) is one of the commonest species, being found abundantly

in New South Wales and Tasmania. It is nocturnal in its habits, sleeping during the day in the branches of trees in so lethargic a condition that, according to Gould, it may be knocked down with a stick or a stone, or even taken by the hand. Even at night it does not capture its insect prey on the wing like the common goatsuckers, but creeps about the stem and branches in search of insects in crevices of the bark, &c. During the breeding season these birds are said also to devour small birds, which they seize upon the nest. The eggs, which are generally two in number, and of a pure white colour, are deposited in September in a carelessly constructed flat nest composed of sticks, and placed in the fork of a horizontal branch at about 5 or 6 feet from the ground. The male assists in the duty of incubation. The cry of this bird is a loud hoarse note. The bird is about 17 inches in length, including the rather long tail. It is of a brownish-gray colour, mottled and spotted with brown, and the wing-coverts are sprinkled with white and tawny spots, which form irregular bands across the closed wings.

The More-Pork Bird (*Podargus curieri*) is so-called by the Tasmanian colonists from its curious cry. It is also found in Australia. It is a rather smaller species than the former, but resembles it in its habits.

PODESTA, the name of an Italian magistrate, which was formerly applied to a higher class of law officers than at present. In the thirteenth century the podestà superseded all ordinary magistrates, judges, and military officers. His office was a permanent one, to which he was appointed by the Great Council of the city; and his duty was to decide the quarrels of the rich citizens and the nobility, and to execute justice on the lawless barons. He often became the despotic ruler of a town or city. The name is now given to inferior judges and municipal magistrates.

PODIEBRAD, GEORGE, King of Bohemia, was born in 1420. He early became one of the trusted leaders of the Bohemian nobility, and became a member of the Ultraquist lay religious order (one branch of the Hussites) at Tabor in 1438. When the Emperor Albert II. died, in 1439, he having been King of Bohemia as well as emperor, his widow was with child, and it was greatly owing to Podiebrad that the succession was kept open and that Wladislas (or Ladislaus) the Posthumous was allowed to inherit the kingdom of a father who had died before he was born. George Podiebrad was unanimously elected one of the two regents, and fulfilled his trust in the most faithful manner, imprisoning his colleague at the first suspicion of treachery (1449). Wladislas gratefully confirmed him in authority in 1453; and when the young king died in 1457 the brave and trusted Podiebrad reaped the proper reward of his patriotism, and was elected king (March, 1458). The Emperor Frederick III., he who had been the patron and master of Pius II. when that remarkable man was only known as the astute and learned secretary of the Council of Basel, Æneas Sylvius Piccolomini, had been a candidate for the crown of Bohemia. Foiled in his attempt, he used his great influence with the Pope, who refused to ratify Podiebrad's election (1462). This was the more inexcusable, as Frederick had himself been already forced to formally acknowledge Podiebrad as king (1459). But, nevertheless, when the emperor was besieged in Vienna by the Turks in October, 1462, and his own people were deserting him, it was the chivalrous King of Bohemia who sent an army to the relief of his sovereign. As a reward for his brilliant services, Frederick induced the Pope to excommunicate Podiebrad as a favourer of heretics, on account of his early Hussite practices, and to cite him to Rome. It is needless to say he did not go. Paul II., who succeeded Pius II., thereupon, in 1465, declared him deprived of the kingdom and excommunicate. The sentence was fulminated afresh in 1466, and Matthias Corvinus, king of Hungary (whom Podiebrad had rescued and

liberated from prison eight years before, when he was elected king of Hungary) was base enough to carry out the Pope's orders to invade his friend's dominions. The bribe was the offer of the kingdom for himself, and he was actually proclaimed king in 1469. Podiebrad, contesting every inch of his kingdom, but continually worsted, appointed Wladislas of Poland his successor, and died, while the fighting still continued, at Prague in 1471. Wladislas succeeded, so great was the magic of Podiebrad's influence, though Frederick III. was straining every nerve to win the prize. Podiebrad is among the noblest figures of the middle ages.

PO'DIUM, in architecture, a pedestal continued horizontally, so as to form a low wall for the support of columns. When it projects forward in such a manner as to afford a base for a pillar it is called a stylobate. Its base, die, and corona are all continuous.

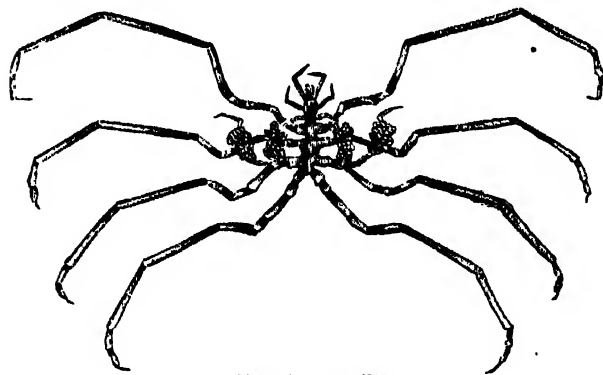
PODOCAR'PEÆ is a tribe of plants belonging to the order CONIFERÆ. The leaves are linear, arranged spirally; the flowers are monocious or diocious; the male flowers are borne on terminal cylindrical catkins, and are short, with two roundish pollen sacs. The female flower consists of an axis swollen above with small scale-leaves, from the axils of which the ovules spring; the latter are anatropous and furnished with two integuments. The typical genus is *Podocarpus*, the species of which are natives of the warmer regions of the world, especially of New Zealand and the Malay Archipelago. One species is the only conifer found in India. Some furnish valuable timber. *Podocarpus Totara* (the totara pine) is the most valuable timber tree of New Zealand, the wood being light, durable, and useful for shipbuilding. Its bark is used for roofing purposes, and the fruit, which is succulent and borne on a thick fleshy stalk, is eaten. Another useful New Zealand species is *Podocarpus ducrydioides*, the white pine of the colonists. *Podocarpus cupressina* is one of the best timber trees of Java, the wood taking a fine polish. Several species have been introduced into this country.

PODOPH'THALMA is a name often given to a subclass of CRUSTACEA, from the eyes being mounted on movable stalks. It contains the two orders DECAPODA (crabs and lobsters) and STOMATOPODA (mantis-crabs, &c.), which are now frequently placed in the larger division of the class Malacostraca.

PODOPH'YLLUM is a genus of plants belonging to the order RANUNCULACEÆ. The best known species, *Podophyllum peltatum*, is called May Apple, Mandrake, or Wild Lemon in the United States. It is a perennial herb with a thick creeping rootstock, which sends up in spring a stem bearing two large, five to nine lobed, peltate leaves with a solitary white nodding flower between them. The fruit is a fleshy berry, egg-shaped and yellowish, containing numerous seeds inclosed in a pulp, which is much relished by some. This species is found in woods and marshy places from Canada to Louisiana. Of late years it has been used largely in medicine for its action on the liver. The dried rootstock, which has a narcotic odour and an acrid taste, is a powerful purgative. A resin, called podophyllin, is extracted from it, and much used as a cathartic in America. The only other species of the genus is a native of the Himalaya Mountains.

PODOSOM'ATA is a remarkable group usually classed with the CRUSTACEA, but showing a resemblance in some respects to the ARACHNIDA. They are small spider-like animals, found among seaweed and under stones between tide-marks, and occasionally dredged from deep water. Some are found attached to fishes. They have a cephalothorax of four segments, and a very rudimentary abdomen. The legs, of which there are four pair, are very long, and, as the scientific name of the group implies, constitute by far the most conspicuous part of the animal. Into each of the legs a branch of the alimentary canal runs. The females

have a fifth pair of legs for the purpose of carrying the eggs, which are collected into globular masses. The suctional mouth forms a kind of beak, and mandibles and palpi are sometimes present. On the cephalo-thorax behind the mouth are usually placed four eyes, though sometimes these organs are very rudimentary or absent. There are no special respiratory organs, breathing being effected through the skin, but a three-chambered heart is present.



Nymphon graellia.

The species are tolerably numerous, two being common on British coasts, *Pycnogonum littorale* and *Nymphon graellia*, the latter [see cut] having legs four times the length of the body, which measures about a quarter of an inch.

PODOSTEMA'CEÆ is an order of plants belonging to the group MONOCHLAMYDÆÆ. They are herbaceous water plants with linear frond-like or minute scale-like leaves. The flowers are hermaphrodite or unisexual, naked or with an imperfect perianth, bursting through a spathaceous involucre. The perianth, when present, is three-lobed or five-partite; the stamens are hypogynous, numerous or few, distinct or monadelphous; the ovary is free, two to three celled, with numerous ovules in each cell. The fruit is a many-seeded, two to three valved, capsule. About 120 species are known, natives of rocky river-beds in the tropics, a few occurring in North America.

POE BIRD. See PARSON-BIRD.

POE, EDGAR ALLAN, an American poet and prose writer of eccentric genius, was born in Baltimore, 19th February, 1809. His father, David Poe, the fourth son of General David Poe, married a beautiful English actress and adopted the stage as a profession after being disowned by his father. Three children were the result of this union—Henry, Edgar, and Rosalie—and when, in 1811, the parents, who had been received into the home of General Poe, died within a few weeks of each other of consumption, Edgar was adopted by his godfather, Mr. Allan, a wealthy merchant, married, but without a child. At the age of eight he went with Mr. Allan to England, where he was placed at a school in Stoke-Newington, in which he remained about two years and a half. In 1821 he was recalled to America and placed at an academy in Richmond, Virginia, and in 1826 he was transferred to the University of Virginia, at Charlottesville. Here he gave way to a passion for card-playing, and he appears to have got so deeply into debt as to offend his patron, Mr. Allan, and though he was honourably distinguished as a student, his stay at the university was limited to a single session. According to several of his biographers, the rupture with Mr. Allan was followed by a visit to Europe, during which Poe joined the Greeks, then fighting for their independence; but it is now known that the hero of this adventure was the elder brother of the poet, and that the latter found a refuge during the next two years at the

home of his aunt, Mrs. Maria Clemm, of Baltimore. Here he interested himself in the training of her daughter Virginia, then a child six years old, who afterwards became his wife. At this period he brought out his first book, a small volume of poetry, entitled "Al Aaraaff Tamerlane, and other Poems." In 1829 Mrs. Allan died, and this event led to a reconciliation between Mr. Allan and Poe, and in 1830 the poet was entered as a military cadet at West Point. He

commenced his duties with apparent ardour, but soon became tired of the place, and conducted himself in such a manner that he was summarily dismissed for neglect of duty. Just before this took place he arranged for the issue, by subscription, of another edition of his poems, which appeared in 1831, under the title of "Poems by Edgar A. Poe," the copies of which were delivered to his classmates after his dismissal from the academy. After leaving West Point, he resided for a time with Mr. Allan, who had married again and become a parent; but his stay was a short one, and after a violent quarrel, Poe quitted the house never to return. What he did during the next two years has not been ascertained, but in 1833 he competed for a prize offered by the proprietor of the *Saturday Visitor*, a Baltimore newspaper, for a prose story, and gained it by his romance, entitled "MS. found in a Bottle." This suc-

cess brought him friends, work, and a local reputation, and from this time to the end of his life he subsisted by literature. His first engagement was in connection with the *Southern Literary Messenger*, for which he wrote some of his best tales, and which for a period he edited. In 1836 he married his cousin Virginia, still almost a child, and the following year he removed to New York, where he wrote criticisms and did editorial work for the *New York Quarterly Review*. After a year he removed to Philadelphia, where he became connected with *Graham's Magazine*, and retained his engagement for the next four years. In 1839 he published a collection of his best stories under the title of "Tales—Arabesque and Grotesque," and in 1843 he gained a prize of \$100 with his tale of "The Gold Bug." In 1844 he removed to New York, where he devoted himself to miscellaneous journalism, and the following year his most celebrated poem, "The Raven," appeared in *Colton's American Review* with the signature "Quarles." This poem was copied into all the more important newspapers and magazines of America, and Poe became the literary lion of the season, but his pecuniary recompense was but the pitiful sum of £2. In 1847 his wife died after a lingering illness, which had lasted eight years. Two years afterwards he visited Richmond, where he became engaged to a lady whom he had loved in his youth, and who was now a widow with the name of Mrs. Shelton, but the engagement never ripened into marriage, for on the 4th October, 1849, Poe was found lying in the streets of Baltimore suffering from inflammation of the brain, and three days afterwards he died in the hospital of that city.

Beginning life with an emotional nervous temperament, and certain unhappy inherited tendencies, the evil influences of his nature were fostered and strengthened by the circumstances attending his youth, and in this way we can account for much of the trouble which clouded the greater part of his career. In his home life he was tender and lovable, and as a literary workman he was patient and painstaking to an extreme degree, but he was at all times lamentably deficient in self-control. The inherited craving for stimulants seems never to have been wholly conquered, and though the poet was at no period of his history an habitual drunkard, he was always in danger of an outbreak which might cause him to fall very low. Then, too, his

work was but poorly paid, and he was wholly dependent upon it; while the long illness of his wife was to him a source of constant anxiety. His misfortunes may be said to have followed him after death, for his literary executor and first biographer, R. W. Griswold, was a man who had long entertained a feeling of enmity towards him—a feeling which he gratified to the full in his memoir of the poet. It would be hard to find elsewhere in literature a similar instance of systematic and deliberate misrepresentation on the part of a biographer; but this libel was printed and reprinted with the successive editions of the poet's works for nearly thirty years, and its true character was never fully exposed until the carefully prepared memoir of Mr. J. H. Ingram appeared in connection with the edition of Poe's works issued at Edinburgh in 1874. As a prose writer Poe excels in tales of a weird and mystical character, the details of which are worked out with wonderful art, and which display a wonderful insight into psychological phenomena. Everywhere you seem to see the scalpel of the anatomist: to watch the operations of the acids or alkalis employed by the analytical chemist, while in those of his stories which turn upon circumstantial evidence, he builds up his narrative with more than the skill of the most practised criminal lawyer. His poems, which make but a thin volume when they are all collected, unlike his prose writings, breathe an air of romantic beauty. Their melody seizes upon the ear with an irresistible fascination, and their wild ringing music and strange mystic imagery clothe measures and fancies entirely original and creative. Excluding imitative writers and literary craftsmen in the poet's art, it is hardly too much to say that Poe stands almost alone as a true poet among Americans. To him, and possibly alone to him of all his contemporaries and predecessors, can one predict with confidence the poet's sublime reward—immortality.

(See "The Works of Edgar Allan Poe," edited by J. H. Ingram: Edinburgh, 1875; "Edgar Allan Poe: his Life, Letters, and Opinions," by J. H. Ingram: London, 1880; "Life of Edgar Allan Poe," by W. F. Gill, fourth edition: New York and London, 1878.)

POET LAUREATE. See LAUREATE, POET.

POETRY (Gr. *poieîn*, to make or create) is the artistic and emotional expression of human thought and feeling in a rhythmic form: not necessarily, therefore, in rhyme, nor even in cadenced lines (take Walt Whitman's work, for instance); in the usual signification of the word, however, it is limited to compositions in metre. As, however, there are certain subjects, feelings, and language, which constitute poetry, a prose composition in which these characteristics are visible is often termed poetical, just as a bad poem is called prosaic.

The art of poetry is an imitative art; but illusion is not its province. The imitative power of art consists in producing results resembling but not identical with those created by natural objects, or by human passion, character, and action. The metre, too, in poetry preserves this essence of art by operating as a constant barrier against any approach to reality, at the same time that it acts as a powerful auxiliary to the sense.

Poetry (*poësis*, or making) seems to be so called because good poetry creates or re-embodies the impressions which the poet has imbibed into his own mind by observation. This faculty of producing from such elements the impression of individual character, action, or scenery, is the power which we generally term imagination; and poetry is but imagination saturated with emotion of an exalted kind. Wordsworth (preface to "Lyrical Ballads") says, "Poetry is the spontaneous overflow of powerful feelings; it takes its origin from emotion recollected in tranquillity."

The old theory of a division of the poetry of any nation into periods or distinct schools for convenience has its uses for study, but it is apt to lead us into errors. Every period

brings to life the aspirations of the previous one, and also holds within itself the germs to be developed in the next. The special characteristics of our English poetry since Tennyson began his work are, besides the national elements, metaphysical. The question of free will and necessity, the limits of mind power, of the existence of matter and its relation to power, the origin and growth and destiny of the soul, the essence of being and the origin of evil, and many others, have crept into the poetry of the last forty years. Another phase is theology, remarkable in "In Memoriam," Byron, Clough, Matthew Arnold, and in a host of minor poets. Shelley threw theology into the arena of poetry, and the germ he had thus sown soon pushed its way into the world. But in our latest poems, not only these theological elements, but even that continuous religious element has disappeared, as if man, having searched for answers to these questions, had been exhausted by the inquiry and given it up. Since the Reform Bill of 1832 social questions have entered English poetry. The evils of society and the true position of women are taken up by Mrs. Browning. She even battles with the question of the social evil. Then follows a poetical interest in the life and lot of the poor. Then suddenly comes a violent classical reaction from this intense modernism to the Greek and mediæval revivals in the poetry of Morris and Swinburne and in the painting of Burne-Jones and Rossetti. For the mechanical part of poetry see PROSODY, METRE, FOOT, HEXAMETER, RHYTHM, RHYME, ANSONANCE, &c.

POGGIO BRACCIOLINI, son of Guccio Bracciolini, was born in 1381, at Terranuova, in the Florentine territory. He studied Latin at Florence, under Giovanni da Ravenna, a disciple of Petrarch, and afterwards Greek under Chrysoloras. About 1402 Poggio went to Rome, where Boniface IX. employed him as apostolic secretary or writer of the papal letters. Boniface died in October, 1404, and his successor, Innocent VII., continued Poggio in his office, which he held under eight successive popes. In the midst of the distractions caused by the great Western schism Poggio withdrew to Florence, where he pursued his literary studies. When John XXIII. was elected pope Poggio returned to his duties of pontifical secretary, in which capacity he accompanied the Pope to the Council of Constance in 1414. During his residence at Constance he visited the Abbey of St. Gall and other monasteries, where he discovered the MSS. of several classical Latin works which were considered as lost, or of which only imperfect copies existed. He either purchased the MSS. or transcribed them, or pointed them out to persons wealthier than himself.

While Poggio was at Constance he witnessed the trial and execution of Jerome of Prague, on the charge of heresy. He gives a most vivid account of that transaction, in a letter to his friend Leonardo Bruni. After Martin V. was acknowledged as legitimate pope, and the Council of Constance was dissolved in 1417, Poggio followed the pontiff on his return to Italy as far as Mantua, where he suddenly left the papal retinue and repaired to England, on the invitation of Cardinal Beaufort. He left England about 1421. Of his remarks during his residence in England there are scattered fragments in his published letters, and still more in his unedited ones. His picture of the manners and habits of the English is not flattering. He resumed his attendance on the popes and his literary labours in Italy. In 1435 he married.

In 1452, on the death of Carlo Aretino, chancellor of Florence, Poggio was appointed his successor. Having now access to the archives of Florence he undertook a Latin history of that republic, which embraces the period from 1350 to 1455. It was translated into Italian by his son Jacopo, and printed in 1476, and afterwards republished in a more correct and improved form by Serdonati (Florence,

1598). The Latin text was not published till 1715. Poggio died at Florence in 1459, and was buried in the church of Santa Croce, near his friend Leonardo Bruni. A statue of him by Donatello is in the Duomo or cathedral.

Poggio was one of the most distinguished scholars of the epoch of the revival of literature. His long life, the offices of trust which he filled, his travels, his extensive correspondence, his multifarious learning, all contribute to render him one of the most remarkable writers of the fifteenth century.

POGOSTEMON is a genus of plants belonging to the order LARIATÆ. The species are numerous, natives of tropical Asia, and most abundant in India and Ceylon. They are tall herbs with opposite stalked leaves, and flowers arranged in close clusters. The calyx is unequally five-toothed; the corolla is two-lipped, the upper lip being three-lobed, and the lower entire and slightly longer; the stamens are four, nearly equal in size and longer than the corolla. *Pogostemon Patchouly*, a shrubby plant about 2 feet high, furnishes the well-known perfume L'ATCHOULL. It has large ovate leaves, 3 or 4 inches in length, and numerous purplish-white flowers, collected in dense terminal and axillary spikes. The perfume is prepared from a volatile oil obtained by distillation from the leaves and young branches.

POIKILITIC (Gr. *poikilos*, variegated), an almost obsolete geological term, occasionally employed for the two formations grouped under the name of NEW RED SANDSTONES, and alluding to the frequently variegated character of their brightly coloured clays and sandstones.

POINT. Euclid's definition of a geometrical point is that it has position but not magnitude. To represent a point we generally use a small dot, but this dot, under the microscope, has a large magnitude, and is clearly recognized as a very poor makeshift. Another definition of Euclid's is that the extremities of a (geometrical) line are points; here the line is a measure of length only, and is supposed to have absolutely no breadth.

Perhaps a better idea of a point can be got from the consideration of a PLANE, which, as elsewhere shown, is a surface between two media. Let the surface or plane be that between a cupful of water and the air: then (as seen in the article PLANE) this surface belongs to neither water nor air, but is of no thickness, and lies between the two. Plunging a piece of cardboard into the water we get a line at the surface, and this line, like the surface or plane, has evidently no thickness. Not only the extremity, but any position on this line, is a point; and the line is an infinity of points, each one of them marking the measureless boundary between two parts of the line, just as the line is the measureless boundary between two planes.

POINT DE GALLE. See GALLE.

POINTED ARCHITECTURE is the more correct name of that magnificent variety of architecture resting upon the pointed arch as a basis, known more generally by the rather foolish name of GOTHIC ARCHITECTURE, under which title the article describing it will be found.

POINTER is a variety of dog used in shooting, and trained to stop and point where the game lies. A good pointer, when it scents game, will remain for a long time immovable with lifted foot and outstretched muzzle. This habit, so valuable to the sportsman, has become instinctive in the breed, for a young dog points the first time it is taken into the field. According to Darwin our pointers are descended from a Spanish breed, and were not known in England before 1688. Since its introduction into this country, the breed has been crossed with the fox-hound. The pointer has a well-built muscular body, short hair, pendulous ears, and pointed tail. The colour is variable.

POINTERS, the two hindermost stars of the northern constellation *Ursa Major* (the Great Bear), familiarly termed Charles' Wain or the Plough. These stars are called the *Pointers* because they guide the eye of the ob-

server to the Pole-star in *Ursa Minor*, which is situated almost in a direct line with them, distant about five times the distance between them.

POINTS OF COMPASS. See COMPASS.

POISON. It is not easy to give an exact and complete definition of this term, but in ordinary medico-legal phraseology it is restricted to such substances as possess an inherent deleterious property, which renders them capable of destroying life by whatever avenue they enter the system. In popular language a poison is a substance which, administered in *small doses*, destroys life; but there are many substances which, given in considerable quantity, are exceedingly fatal, while given in small quantity they produce no symptom of importance. It is not applied to substances, such as powdered glass, sponge; &c., which act only mechanically, nor to those which act injuriously through qualities merely superadded for the time being. Thus, if a person were to swallow boiling water its effect would be as fatal as most poisons, but as this would not arise from any inherent quality of the water, and merely from the heat added to it, we could not speak of the evil results as poisoning. In the administration of the law, however, no attention is paid to the manner in which any hurtful substance administered acts. If it be capable of destroying life or injuring the health of one individual, it is of little consequence, so far as the responsibility of the prisoner is concerned, whether its action on the body be of a mechanical or chemical nature. Thus it is laid down that "whoever shall administer, or cause to be taken by any person, any poison or other destructive thing, with intent to commit murder, shall be guilty of felony, and being convicted thereof shall suffer death." The attempt to administer any poison or other destructive thing with like intent, &c., although no bodily injury be effected, is felony, and may be punished by penal servitude for life, or any lesser term.

Poisons may exert a twofold action—viz. local or remote; or these influences may be combined in one substance. Some substances act almost entirely on the parts with which they are brought in contact, causing corrosion, inflammation, or an effect on the nerves of sensation or motion, and the symptoms arising from their action are designated local; but others act only when they have passed into the blood and reached some distant organ, usually the brain, such action being described as remote.

Numerous attempts have been made to classify poisons rationally, but most of the classifications have been of the crudest description, and even at the present day the task is found one of considerable difficulty. In early times it was usual to divide poisons into three groups, mineral, vegetable, and animal; and at a later period, when the need of a division, which should reflect in some degree the effects produced, became apparent, they were divided into irritants, narcotics, and narcotico-irritants—a grouping still adhered to by many writers. More recently the division into—(1) *Corrosives*, (2) *Irritants*, and (3) *Neurotics* has been proposed, the subdivision of the latter class, which includes poisons so widely different in their action as opium and strychnine, being left open until more progress has been made in the knowledge of the subject.

The *Corrosives* are poisons which, by virtue of their chemical properties, destroy the surface and sometimes the deeper parts of all the organs with which they are brought in contact, their influence being generally manifested immediately they are swallowed, and which, in consequence, are speedily fatal in their action. Chief among these poisons are the strong mineral acids—sulphuric, nitric, and hydrochloric; the three chief alkalies—caustic potash, soda, and ammonia; oxalic acid; carbolic acid; the corrosive salts of the metals, such as bisulphate of potash, nitrate of silver, &c., and the soluble chloride of mercury or corrosive sublimate. The symptoms which follow the

administration of these poisons are tolerably characteristic, and except in the case of infants they are usually unmistakable. Immediately after swallowing the corrosive substance, an acid, caustic, or metallic burning sensation is felt in the mouth, throat, and stomach, and this quickly spreads over the whole of the abdomen. In the majority of cases vomiting speedily ensues, first of the ordinary contents of the stomach, and afterwards of mucus, blood, and portions of the membrane lining the gullet and stomach, and when the alkalis have been taken there is also violent purging. The lips and tongue are commonly marked, sulphuric and hydrochloric acid causing them to become white at first, and afterwards black, while nitric acid always gives rise to a yellow stain. Carbolic acid also causes a whitening and shrinking of all the animal membranes with which it comes in contact. The pain is usually very severe, and it is attended with thirst, great prostration of strength, cold and damp skin, extreme anxiety of countenance and manner, and often by considerable difficulty in breathing. Soon signs of collapse are apparent, and the patient generally dies within a few hours. Even where the patient survives the immediate effect of the poison, it is often only to die of slow starvation a few months afterwards, owing to the closing up of the œsophagus. In some cases the fatal result may ensue a few minutes after the administration of the poison, oxalic acid frequently causing death by its specific action upon the heart before the local action has had time to develop, while carbolic acid speedily renders the patient insensible from its power of affecting the great nervous centres.

The *Irritants* are divided into two classes—viz., *metallic irritants* and *vegetable and animal irritants*, the two latter being grouped together for convenience. It is not supposed that any of the poisons included in this class act purely as irritants, inasmuch as they all give rise to well-marked effects upon the nervous system, though formerly they were designated pure irritants in order to distinguish them from the corrosives. The metallic irritants comprise arsenic (perhaps the most important), the moderately diluted acids, the white and red precipitates of mercury, sulphurets of mercury, peroxides, and nitrates of mercury, acetate of lead, sulphate of copper, arsenite of copper or Scheele's green, tartar emetic, chloride of antimony, sulphate and chloride of zinc, and the salts of tin, silver, chrome, iron, &c. The vegetable irritants are very numerous, good examples being found in gamboge, scammony, elaterium, croton-oil, castor-oil seeds, oil of turpentine, oil of tar, ergot of rye, and euphorbium. Of animal irritants cuttlefishes may be taken as a typical example. The symptoms which follow the administration of an irritant, though they are less speedily manifested, greatly resemble those enumerated in connection with the corrosives. Usually after an interval, greater or less according to the nature or quantity of the irritant swallowed, there is a sensation of burning heat in the mouth, throat, and gullet, accompanied with redness and swelling, and followed by a burning pain in the stomach, with nausea and retching, or vomiting, tenderness on pressure, and tension of the upper part of the abdomen. Ordinarily the vomiting is followed by profuse diarrhoea, and where the poison is not quickly eliminated from the system the symptoms increase in their severity, and the patient dies in convulsions or sinks into a state of collapse, which is soon brought to a fatal termination. It must be observed here that similar symptoms occur in various forms of idiopathic disease, such as gastritis, peritonitis, severe colic, cholera, and rupture of the stomach or intestines, so that in a fatal case of suspected poisoning it is rarely possible to decide upon the evidence of the symptoms alone. Recourse must therefore be had to *post-mortem* examination.

Under the head of *Neurotic* poisons are grouped a large number of poisons which in their action primarily

affect the nervous system, including opium, prussic acid, strychnia, digitalis, aconite, belladonna, alcohol, ether, chloroform, and many others. The symptoms produced by these poisons are necessarily of the most varied character, and such as cannot be included in any general description. The narcotics, of which opium and its various compounds may be taken as an example, generally cause giddiness, headache, obscurity or deprivation of sight, dilation or contraction of the pupil, stupor or perfect insensibility, loss of power of the voluntary muscles, and towards the close complete coma. To these general results the several species of narcotics add effects peculiar to themselves, yet not so characteristic but that they are closely simulated by those of some natural diseases. The symptoms of apoplexy, for example, are very similar to those of poisoning by opium and other substances of a kindred nature, but in certain cases the following points may help to distinguish them:—Apoplexy, though its actual attack is sudden (which the effects of opium are not), is often preceded by headache, dizziness, and other warning symptoms. If so severe as to simulate poisoning it is not possible to arouse the patient from his stupor, but in poisoning with opium this may usually be effected to within a few hours of death; in apoplexy convulsions often occur, in opium poisoning never; in the former the pupil is often dilated, in the latter contracted. Narcotic poisoning, if not fatal in twelve hours, usually terminates in recovery; apoplexy often proves fatal after several days. Prussic acid produces its effects in the course of a few minutes, or when a large dose is taken in the course of a few seconds. The symptoms are difficult respiration, irregularity in the beating of the heart, convulsions, dilation of the pupils, extreme collapse, and cyanosis. Poisoning with strychnia and brucea closely simulates tetanus, but the convulsions do not begin in the lower jaw, do not affect the same groups of muscles as are implicated in tetanus, and they are much aggravated if the patient is touched, a very characteristic feature. Alcohol, taken in large quantities, causes complete loss of the power of motion, insensibility, stertorous breathing, the skin being cold and clammy, and the temperature low, but the condition can only be diagnosed with certainty by emptying the stomach and examining its contents.

In addition to the classes indicated, there are numerous poisons which are found in food substances, of which the nature is but little understood. In ordinary practice cases of poisoning by fish, crustacea, and the so-called shell-fish of our islands, are not unfrequently met with, crabs, lobsters, and mussels being usually the cause. The symptoms, though distressing for a time, are not usually of a serious nature, but the use of mussels is occasionally followed by fatal results, though the reasons for this have not yet been discovered. Sausages, hams, and other preserved meats sometimes develop very poisonous qualities, the sausage poison observed in Germany being especially fatal in its results. Several varieties of poisonous fish are found in the tropics, and the poisonous nature of the flesh of animals which have fed on certain plants has been abundantly demonstrated. Honey obtained from poisonous flowers sometimes produces symptoms of poisoning, and even the milk of goats and other Mammalia which have browsed on poisonous herbs, has proved poisonous.

Another class of poisons may be found in what are sometimes called *venoms*, and which are mostly of animal origin. Among the most familiar are the saliva of a dog attacked with hydrophobia, the poisonous secretions of many serpents, of spiders, centipedes, scorpions, and other arachnids, and of many insects, principally Hymenoptera, Hemiptera, and Diptera. Certain fishes also appear capable of inflicting poisoned wounds. Putrescent animal matter likewise proves rapidly fatal if introduced into the blood by a puncture. The general symptoms produced by a poisoned wound or sting are swelling, discolouration, and

inflammation of the part. The inflammation spreads rapidly, and in severe cases often terminates in mortification. General prostration of strength comes on, and the patient often grows insensible or delirious. In fatal cases decomposition ensues with great rapidity.

Gaseous poisons are also a distinct class, their effects being varied, some of them acting as irritants, while others appear to form chemical compounds with the red pigment of the blood, thus destroying its capability of acting as a carrier of oxygen. Chlorine, bromine, hydrochloric acid gas, sulphurous acid gas, nitrous vapours, and ammonia gas, are all irritants, and inhalation is often followed by fatal results. Carbonic acid gas is totally irrespirable when pure, and is fatal when present in large quantities in respired air. It is given off from burning fuel, and thus people are sometimes suffocated by the vapours arising from a small fire in a closed room, and it accumulates in pits, wells, and partially filled vats in which fermented liquors are stored. When it is breathed in a concentrated state it causes almost instant death, and when it is inhaled in a diluted form it gives rise to a feeling of drowsiness, which passes into a condition of stupor and insensibility, with stertorous breathing and muscular prostration, death usually occurring quickly and without convulsions. Carbonic oxide, which is given off in burning charcoal and some other forms of fuel, is found in the emanations from brick kilns; it is also one of the constituents of coal gas, and is a much more dangerous agent than carbonic acid. An atmosphere which contained 1 per cent. of carbonic oxide would cause death if breathed for a few minutes, and even a smaller proportion than this would bring about fatal results if the breathing extended over a longer period. Coal gas, which acts as an asphyxiant and narcotic, appears to owe its chief effect to the carbonic oxide it contains. Sulphuretted hydrogen gas is also highly poisonous, and in a concentrated form it causes almost instant death from asphyxia.

Excluding the gaseous poisons, most of the others are in their nature specific—i.e. what is noxious or fatal to one animal species having occasionally little or no action upon others. Thus the hedgehog can devour any quantity of fresh-caught Spanish flies without inconvenience, and is proof against the bite of the viper and against inoculation with the famous woorali or curari poison. The common garden slug can devour the leaves of the deadly digitalis; the goat can eat freely of tobacco, &c. Even in one and the same species different individuals may from idiosyncrasy or habit be very differently affected by a given poison. Thus habitual opium-eaters frequently consume in a day a quantity of that drug sufficient to destroy eight or ten ordinary men; and the peasants of Styria, who habitually eat arsenic, are stimulated to active exertion by doses of that poison which would quickly prostrate and destroy ordinary individuals. On the other hand, certain articles of food have been known in persons of peculiar constitution to produce all the symptoms of a violent poison. Pork, mutton, fish, butter, mushrooms, &c., have all produced symptoms of irritant poisoning in persons who have had a constitutional aversion to such articles of diet, while others who partook of the same food at the same time experienced no inconvenience.

With respect to the treatment to be adopted in cases of poisoning, it must of necessity be varied according to the circumstances of each case. Beginning with those poisons which are introduced into the system by means of a puncture in the skin, the first precaution should be to suck out the poison if the part is accessible and the gums and lips be sound. Given the latter condition this may be usually done with impunity, as many of the poisons which are most deadly when introduced into the circulation are quite inert when swallowed; while, as a rule, there is no need to swallow anything, and the mouth may be speedily

cleansed after the operation. Next, a tight ligature should if possible be applied over the part bitten, the wound should be enlarged and allowed to bleed freely, after which it should be effectually cauterized by means of a hot iron, nitrate of silver, or some other escharotic. Subsequent internal treatment must depend upon the special circumstances of the case. In the case of corrosive and irritant poisons the first thing to be done is to assist in their elimination from the system by exciting vomiting or by increasing that already set up. Copious draughts of tepid water may be given for this purpose in any case, while more active emetics may be found in mustard and salt. A handful of salt dissolved in a pint or so of water will usually suffice to produce copious vomiting, and so the evacuation of the stomach contents. Mustard in quantities of a tablespoonful stirred up in a pint of lukewarm water is a still more active emetic, but its use is limited to those cases where there is no violent irritating effect produced by the poison. Usually it suits best where there is a sedative effect produced by the poison, and the stomach requires a stimulant to call its action into full play. After the evacuation of the stomach has been procured, it may be protected from the irritant effects of the poison by the use of mucilaginous drinks, such as weak gum water, linseed tea, sugar and water, &c. In cases of corrosive poisoning the stomach pump cannot be used on account of the danger of perforating the gullet, but in cases where a non-corrosive poison has been taken, its use is often of the utmost value. It is especially useful in cases of opium poisoning and acute alcoholic coma. In cases of narcotic poisoning, after the stomach has been evacuated of its contents, the patient must be kept from sleeping by walking him about in the open air, alternate hot and cold applications to the chest, flicking the feet with a damp towel, shouting in the ear, the use of the electric current, &c., and as a last resort artificial respiration must be employed.

With respect to the use of antidotes, the best remedy for the mineral acids is some weak alkali, such as calcined magnesia beaten up with water or milk, and given in considerable quantity. Other remedies are found in chalk and water, whiting and water, or even the uncoloured plaster from the walls or ceiling ground up fine and mixed with milk or water. The alkalis must be dealt with in exactly the opposite fashion—they must be neutralized by some weak acid, such as vinegar or lime juice in water, oil or milk being afterwards administered. Oxalic acid is best treated by means of common whiting in water, but chalk, ground plaster, or anything containing carbonate of calcium may be pressed into service. The effects of arsenic may be mitigated by the use of hydrated peroxide of iron, followed by demulcent fluids, such as flour and water or milk, while the deadly corrosive sublimate may be converted into an insoluble mass by the use of the white of eggs.

We subjoin a list of simple remedies which may be resorted to in cases of poisoning where proper skilled medical assistance cannot be obtained in time:—

Acids, Mineral (sulphuric, muriatic, nitric, &c.)—Chalk or magnesia stirred up in water; oil and afterwards milk.

Alkalies (soda, potash, and ammonia).—Vinegar and water; lime-juice and water; oil.

Antimony.—Abundance of warm water; strong infusions of tea or coffee; decoction of oak bark.

Aconite.—Emetics of warm water; strong black coffee or tea; brandy; artificial respiration.

Arsenic.—Powerful emetics if vomiting has not already set in; hydrated oxide of iron; magnesia; sugar and water.

Belladonna (leaves or root).—Emetics; stimulants; and after some time an active purgative.

Blue Vitriol and other compounds of Copper.—Sugar and water; white of egg.

Cantharides.—Emetics; white of egg (not the yolk); mucilaginous drinks.

Chloral Hydrate.—The same as for opium.

Chloride of Zinc.—White of egg; milk; carbonate of soda.

Chrome.—Emetics; abundance of chalk, oil.

Corrosive Sublimate and other compounds of Mercury.

—White of eggs beaten up with water, or failing these, flour made into a thin paste; milk mixed with once or twice its bulk of lime-water.

Digitalis.—Emetics; stimulants; the maintenance of the recumbent posture.

Lead, compounds of, and Baryta.—Epsom salts; sulphate of magnesia.

Lunar Caustic.—Salt and water.

Opium, in any of its preparations.—Emetics; external stimulation by warmth, turpentine, or camphor liniments; enforced exertion; cold water thrown in the face; strong tea or coffee; artificial respiration.

Oxalic Acid.—Emetics; chalk, whiting, or ground plaster in water or milk.

Phosphorus.—Magnesia in considerable quantity, followed by mucilaginous drinks; oil of turpentine in doses of 10 minims frequently repeated.

Prussic Acid.—Alternate douches of hot and cold water; friction of the limbs; artificial respiration.

Strychnia.—Emetics; and, under medical supervision, chloral, chloroform vapour, or nitrite of amyl.

For gaseous poisons the proper treatment is removal into the fresh air, the use of alternate hot and cold douches to the chest, friction of the limbs and trunk to assist the circulation, artificial respiration, and the use of the galvanic current.

In connection with this subject it may be mentioned that the annual reports of the registrar-general show that apart from murders and suicides, there are generally between 200 and 300 deaths from accidental poisoning in England alone every year. The two great causes of this mortality are found in—first, the giving or taking of overdoses of certain remedies containing poisons; and second, the substitution of a poison by accident for some harmless drug. Great care should always be exercised in the administration of powerful drugs, and patients should rarely be allowed to measure or repeat the dose for themselves. This precaution is especially necessary where opiates are used, for when prolonged pain or sleeplessness is present the temptation to exceed in quantity or to repeat the dose too quickly is sometimes almost overpowering. Experience shows that narcotic poisons cause a much larger number of deaths than either of the other classes of poisons. As a precaution against the second danger indicated, attendants upon the sick, and those who keep medicines in their houses, should never keep bottles or packets of poison alongside of those intended for internal use. For the same reason, carbolic acid, oxalic acid, or any of the stronger acids, should never be put into beer bottles, jugs, cups, or other vessels which both children or adults are apt to associate in their minds with fluids of a potable character.

POISONING, SECRET, is a mode of taking away life by poisons administered in such a way as to cause the symptoms to resemble those brought about by natural disease. It is a crime of very great antiquity, and numerous allusions to it are found in the classic writers, though it is not included by the Hebrew prophets among those which they denounce as prevalent among their contemporaries. Most of the Old Testament references to poison, indeed, seem to refer to animal venoms, though the "water of Rosh," which is variously rendered in the Authorized Version, is supposed by some commentators to be a vegetable poison. Among the Greeks and Romans the preparation of poison was closely connected with the practice of sorcery. Among the Romans the crime of secret

poisoning was at some periods very prevalent, and Tacitus mentions several instances of its practice ("Annal." xii. 66, xiii. 15). Many similar instances may also be found in Greek history. Theophrastus speaks of a poison prepared from aconite which could be regulated in such a manner as to take effect in two or three years; and he also relates that Thrasyas had discovered a method of preparing from other plants a poison which, given in small doses, occasioned an easy but certain death without any pain. It is said that a poison of the latter character was much used at Rome about 200 years before the Christian era. The poisons used in antiquity seem chiefly to have belonged to the vegetable kingdom, and to have been prepared from aconite, hemlock, and poppy. Certain animal poisons are referred to by classic writers, but they do not appear to have been acquainted with mineral poisons.

In later times secret poisoning has often been very prevalent, especially in Spain and Italy. In the latter country, from the Lombard invasion down to the seventeenth century, poison was the weapon most in favour for obtaining wealth or revenge. The Borgia family has obtained an unenviable notoriety from the extensive use of poison by its members, and their skill in its administration, but they do not appear to have been much worse than their neighbours. A singular combination of poisoners was discovered at Rome through the revelations of the clergy during the pontificate of Alexander VII. in 1659. It appeared that a woman named Hieronyma Spara, who passed for a fortune-teller, had for many years prepared and sold a colourless, tasteless, liquid poison to women who wished to get rid of their husbands, and that in consequence a most unusual number of young widows were to be found in the city. By some skilful manoeuvres on the part of the police the whole proceedings were brought to light, and La Spara and thirteen of her companions were hanged. A large number of women were publicly whipped half naked through the streets of Rome, while several ladies who were protected by their high rank from the ordinary punishments of the law, were fined and banished. In France, about 1670, occurred the crimes of Marguerite d'Aubrai, wife of the Marquis of Brinvilliers, of which an account has already been given under BRINVILLIERS, MARQUISE DE. Towards the close of the seventeenth century a woman named Tofania prepared and sold at Naples a poison similar to that of La Spara, and succeeded in carrying on her abominable trade undiscovered for nearly fifty years. The poison was sold at Naples in small flat vials under the name of *acquetta*, while it was placed in vessels of a different shape and labelled "Manna of St. Nicola of Bari" for use in other parts of Italy. Tofania was at last arrested and tried, and after being put to the torture, was strangled in 1719. She is said to have provided the means for the murder of over 600 persons, and the poison she prepared, about which so many extravagant stories have been told, is supposed to have been a preparation of arsenic.

In modern times, from the rapid progress made in pathology, analytical chemistry, and the use of the microscope, secret poisoning has been rendered more difficult, and in consequence more rare, and this in spite of the fact that the number of poisons known at the present day is vastly greater than that of earlier periods. Mineral poisons as a rule possess powerful antiseptic properties, and being in themselves indestructible, and possessing striking reactions, they can be detected, if sought for, even long after death. Arsenic, for instance, has been detected in human remains after a lapse of eight years, during which the bodies had been buried. The poisons of organic origin and those of a volatile character are more difficult of detection, but the convictions of Dr. Palmer, who used strychnine, Dr. Pritchard, who employed tartar emetic, and Dr. Lamson, who administered the comparatively un-

known drug aconitine, afford striking proofs of the skill of modern toxicologists. Now and again the history of crime affords examples of persons who use poison with a cold-blooded malignity and determination that appears to verge upon insanity, and who remain undetected for years, but it is probable that those epidemics of this form of crime to which we have referred as characterizing certain periods of history have finally disappeared from the civilized world. Certainly every murder of modern times has but made the detection of future crime more easy, and even in cases where justice has been baffled, it has only served to direct the attention of scientific observers more closely to the subject.

POITIERS, the capital of the French department of Vienne, is situated on a rocky hill on the left bank of the Clain, a feeder of the Vienne, 206 miles by railway S.S.W. from Paris, 63 south by west from Tours, and has 36,210 inhabitants. It is one of the oldest towns in France, and occupies the site of *Lemonum*, the chief town of the Pictones, who are mentioned by Julius Caesar, and from whom the names, Poitiers for the town, and Poitou for the old province, are said to be derived. Upon the downfall of the Roman Empire the town was pillaged by the Vandals in 410; it subsequently came into the hands of the Visigoths, from whom it was taken by the Franks. The neighbourhood of Poitiers has been the field of three great battles: the defeat of the Visigoths under Alaric II. in 507 by Clovis and his Franks at Vouillé, a village a few miles west of the town; the defeat of the Saracens, commanded by Abdur-Rahman, by the Franks, commanded by Charles Martel, in 732, somewhere between Poitiers and Tours; and the victory of the Black Prince at the head of 14,000 English and Gascon soldiers, on 19th September, 1356, over an army of 60,000 French troops under John II., who was taken in the action and brought to England. By the marriage of Eleanor of Guienne to Henry Plantagenet, Poitiers came into the hands of the English kings, who held it till 1204, when it was wrested from them by Philippe Auguste. By the treaty of Breigny in 1360 it was ceded to England, but it reverted to France in 1372, by the voluntary surrender of the townsmen to Charles V. For fourteen years, while the English were masters of the greatest part of France, Charles VII. kept his court and Parliament in Poitiers, and great additions were then made to the extent of the town. During the religious wars it was taken from the Huguenots by the Catholics, and was the scene of great cruelties; Admiral Coligny made an unsuccessful attempt to retake it in 1569.

Poitiers is inclosed by old turreted walls pierced by six gates, four of which open on bridges over the Clain. The space within the walls comprises large gardens and orchards, so that the extent of the place is much greater than the population would lead one to suppose. The streets are mostly narrow and steep, but a few of them have been widened and modernized. The most remarkable structure is the Cathedral of St. Pierre, commenced by the English Henry II. in 1152, but not finished till 1379. Here are interred the remains of Richard Cœur-de-Lion. The other remarkable religious edifices are—the Church of Sainte Radegonde, with a crypt and nave, which date from the twelfth century; the Church of Montierneuf, which belonged to a Benedictine abbey, and was finished in 1069; the Church of Notre Dame, a Byzantine structure, dating partly from the ninth and partly from the eleventh century; the Church of St. Porchaire; what remains of the ancient Basilica of St. Hilaire, erected in the beginning of the eleventh century; and near the cathedral the Church of St. Jean, a venerable monument of the fifth century, which now serves for a museum of antiquities. In the centre of the town stands a large building called the Palais, formerly the residence of kings and of the hereditary counts of Poitou, but now used as a town-hall and chambers for the

courts of justice. Besides the collection of antiquities Poitiers has a public library of 80,000 volumes, a cabinet of natural history, a botanical garden, and a departmental nursery. Of Roman structures there are still remaining some arches of an aqueduct to the south of the town, a pagan burial-ground, some Christian tombs, and within the walls the ruins of a vast amphitheatre, which is called Les Arènes.

Poitiers is the seat of a University Academy, connected with which there are a faculty of law, a secondary school of medicine, and a national college. The other institutions are civil and commercial tribunals, a consultative chamber of manufactures, a free school of design and architecture, several literary, scientific, and agricultural societies, a theatre, hospitals, &c.

The chief manufactures are coarse woollen cloth, blankets, hosiery, lace, hats, playing cards, vinegar, leather, and dressed skins. The trade in these articles and in seeds, wheat, wine, wool, hemp, flax, wax, honey, hides, and dressed goose skins, with the down on, for furriers, is considerable.

POITOU, a province of France, which is now mostly included in the departments of Vienne, Deux-Sèvres, and Vendée, was bounded north by Anjou and Bretagne, east by Touraine, Berri, and Marche, south by Saintonge and Aunis, and west by the ocean. It was divided into Haut Poitou and Bas Poitou, which had Poitiers and Fontenay for their respective capitals. Poitou is the country of the Celtic Pictones. Under the Roman Empire it formed part of Aquitania Secunda; it was invaded successively by the Vandals, the Visigoths, and the Franks, and was, under the sway of the last, governed by its own counts, until it fell into the hands of the English on the marriage of Henry Plantagenet to Eleanor of Guienne in 1152. Conquered by Philippe Auguste in 1204, it was ceded to the English by the treaty of Breigny in 1360, and finally reunited to the crown of France in 1375 by Charles VII. The inhabitants of the province were called Poitevins.

POKE-WEED. See PHYTOLACCA.

POLAC'CA, the Italian variety of the musical form better known as **POLONAISE**.

POLAND. In the fifteenth century Poland extended from Russia on the east to Germany on the west, and from the Baltic on the north to Turkey on the south. Its area was larger than that of France, and its population is supposed to have amounted to 15,000,000. The comparatively small portion of this once powerful state, which, under the name of the Vistula Province, now forms an integral part of the Russian Empire, is bounded on the north by East Prussia, on the east and north-east by Wilna, Grodno, and Volhynia, on the south by Galizia, and on the west by Silesia and Posen. The area is 49,167 square miles, and the population 7,083,475.

Soil and Surface.—Though Poland is generally considered a perfect level, the surface exhibits considerable diversity, and some districts rise many hundred feet higher than others. The boundary between the kingdom and East Prussia occurs at the swelling ridge, 400 or 500 feet high, which forms the southern extremity of the plain of the Baltic; and the southern districts of the country contain offsets of the Carpathians, which rise in some places to an elevation of 1000 feet. The soil varies greatly in different parts, but consists chiefly of a sandy loam, resting on granite, and includes some very rich fertile ground on the banks of the rivers. The range of temperature is very great: the summers being very hot, and the winters often intensely cold—the thermometer sometimes falling to 10 degrees below zero. The land is usually snow-clad and frozen for five months in the year. In general the atmosphere is humid, rainy and cloudy days occupying half the year.

The most considerable rivers are the NIEMEN and

VISTULA or **Wisla**, which are navigable for large river barges as far as they drain Poland and flow along its boundary lines. The other principal rivers are the **Wieprz**, **Bug**, **Narew**, **Pilica**, **Warta**, and **Prosna**. Lakes are most numerous in the north-eastern district, but are not large. Altogether the country is well watered.

Productions, Industry, and Trade.—Though Poland cannot yet be considered a highly cultivated country, agriculture has been greatly improved, and it now produces far more grain, hemp, flax, and tobacco than are required for its consumption. Wheat is very abundant in the hilly southern region, where the kind called “Dantzic white” is grown; the principal species of grain which are cultivated in the other parts of the kingdom are rye, oats, and buckwheat; barley is also raised, but less extensively. Leguminous vegetables are much valued, and their cultivation well attended to. Horses, cattle, hogs, and goats are reared, and are of excellent breeds. Sheep are not so common, as they are very liable to be killed by the wolves. Swarms of bees abound, and there is a large export trade in honey. As a considerable part of the country is still covered with forests, timber constitutes an important article of export. The forests consist of oak, ash, lime trees, and birch, but chiefly of pine and fir. Among these the forest of **Bialowieza** is perhaps the largest single remnant of the primitive woods of Europe. The site is noteworthy also on account of its aurochs, of which about 1500 survive. This animal is supposed by **Cuvier** to be a distinct species of the genus *Bos* or ox, which man has never subdued, and is one of the most massive of all existing quadrupeds. As late as the reign of **Charlemagne** it was not uncommon in Germany, but is now fast following its extinct congener, the *urus* of **Cæsar**, from which the common ox has descended. No living specimens are known, except in this Lithuanian forest. Wild animals are numerous, especially wolves. Lynxes have become rare, as well as the beaver, ermine, and elk; but deer, foxes, martens, polecats, badgers, and weasels are still very common. Pike abound in the rivers.

The mineral district, situated in the south-west of the country, is tolerably rich in ores, but the produce is now limited to iron, zinc, and a little coal. Formerly silver, copper, lead, and a large quantity of sulphur, were obtained. The celebrated salt mines of ancient Poland are in **Galizia**, now a province of the Austrian Empire, and are worked by the government of that country.

The other principal industrial establishments of the country consist of sugar factories, distilleries, breweries, paper and oil mills, ironworks, linen, woollen, and cotton factories, glass works, and tanneries. Agricultural and other machinery, carriages, clocks, musical instruments, and hosiery, are also made, and tobacco is largely manufactured. The internal commerce is chiefly carried on by means of fairs. The establishment of a great line of railway, connecting **Warsaw** with **St. Petersburg**, **Berlin**, and **Vienna**, has done much to raise the trade of Poland, and the opening of the **Warsaw-Moscow** line still further promoted this object. In the districts not served by railways goods are conveyed in summer by waggons and in winter by sledges. Of the imports the most important as regards the trade with Great Britain are tea, coal, machinery, and hardware. The principal exports of the country are corn, hemp, flax, tobacco, timber, honey, and the produce of the mines.

Religion, Education, &c.—The greater number of the Poles belong to the Roman Catholic or the United Greek Churches, the Græco-Russian communicants being few in number. There is an archimandrite of the Græco-Russian Church, who resides at **Warsaw**. The bishop of the United Greek Church has his abode at **Helina**, in **Lublin**. The Roman Catholics have an archbishop at **Warsaw**, and eight bishops in different parts of the kingdom. Until 1867 they were nominated by the Pope, subject to the approval

of the Emperor of Russia; but the violent measures of the Russian government against the Romish Church brought the arrangement to an end. A ukase, issued after the rebellion in 1864, suppressed 120 monasteries, either for having openly favoured the rebels or because the inmates were below a certain number. In the following year a still more fatal blow was dealt to the power of the Roman Catholic Church, when the whole of its lands were taken possession of, and the clergy placed on fixed state pay. The education, even of Catholic children, was also placed under the direction of the orthodox Greek Church; and it was made unlawful for a refugee whose property had not been confiscated, to sell it to any but a member of the Russian Church. The Lutherans and Calvinists, amounting together to about 220,000 persons, are principally Germans. There are a few Mennonites and Moravians, some Mohammedans, and a very large number of Jews. Every child is compelled to learn the Russian language, and no person is allowed to be employed as a tutor unless he produces testimonials from the proper authorities certifying his ability to give instruction in that tongue. Private schools are subject to the same inspection on the part of the government as public ones.

The Poles are a remarkably fine race of people, being well formed, strong, and active. In their general appearance they are said to resemble the Western Asiatics rather than the Europeans, and are most probably of Tartar origin. According to the old laws of the republic the nobles were *terrigena*. Every person who possessed a freehold estate, however small, or who could prove his descent from ancestors formerly possessed of such estate, and who had not lowered his position by engaging in manufactures or commerce, was a nobleman or gentleman—the terms in Poland being synonymous. The gentry were all held to be equal to one another, the titles of prince and count, which some of them enjoyed, not being supposed to add anything to their real dignity. Under the republic the nobility were supreme. They were absolute lords of their estates, and of the boors by whom they were occupied. They enjoyed the royal privilege of maintaining troops and constructing fortresses; and they only could elect the sovereigns. No noble could be arrested without previous conviction, except in cases of high treason, murder, or highway robbery; and then only provided he were taken in the act. Under the government of Russia, Austria, and Prussia, the privileges of the nobles have been suppressed; and an imperial ukase, published 10th March, 1865, made a still further revolution in the social state of the country, by constituting the peasants the actual possessors of the lands they had previously held on leases.

The general prosperity enjoyed by Poland of late years has been largely shared by the labouring classes, who find their material comforts greatly increased. There is no special legislation for them, and on the other hand there is little interference. Strikes are unknown, and the quality of workmanship is such that many German goods are fast losing the Polish and Russian markets. Sanitary legislation is very backward, and is urgently needed, the defective drainage and bad water favouring the spread of frequent epidemics.

Jews are more numerous in Poland than in any other country in Europe, and are in almost exclusive possession of the trade and commerce; but, notwithstanding, the majority of the Israelites are extremely poor. They seem also to be in a lower state of civilization than any other class. Even the richer individuals, who occupy the best houses in the towns, appear to care little for cleanliness or comfort; and the lower orders live in a state of filth and discomfort that would be intolerable anywhere else. The Poles are especially liable to endemic diseases, such as small-pox and fevers; but the most remarkable and dreadful complaint is the *PLICA POLONICA*.

History.—Little is known of the history of Poland previous to the introduction of Christianity. Christianity was introduced by Miecislav, in 965, after his marriage with a Bohemian princess. Boleslav was made king of Poland by the emperor in 1000, and raised the kingdom to great power. It became still more prosperous in the reign of Boleslav II. (1058–82). Boleslav III. (1102–38) was also a distinguished sovereign, but he destroyed the effects of a brilliant reign by his injudicious partition of the country among his four sons—a custom which was common at that time in many countries. This partition, by destroying the unity of the kingdom and producing internal wars, was productive of much mischief, and arrested the development of the Polish monarchy, which, being the most important Slavonic state, might have become a centre of unity for the race. Poland recovered from this state of weakness in 1308, under Wladislaw IV., one of the greatest monarchs that ever governed Poland. The most memorable event of his reign is the first Diet of Poland, which he assembled at Clenchy in 1331.

The reign of his son, Casimir the Great, was devoted to the consolidation of the advantages gained by his father. The first code of laws was published in Poland by his orders at the assembly of Vislitz, in 1347. The native dynasty ended with him. He was succeeded by his nephew Louis, king of Hungary, in 1370. Although he paid little attention to Poland during his lifetime, Louis was very anxious to secure the throne to one of his daughters, an object which he accomplished by granting to the nobles, or equestrian order, many privileges, and by a considerable reduction of taxes, in 1371. In consequence of this agreement his youngest daughter, Hedwige, was proclaimed after his death Queen of Poland, in 1382, and was crowned at Cracow, being then only fifteen years of age. Jagellon, whom she afterwards married, brought the whole of his duchy of Lithuania under the rule of Poland. Jagellon was succeeded by his son Wladislaw VI., a prince then eleven years old. He was scarcely of age when the Hungarians, threatened by the fast-spreading power of the Ottomans, invited him to their throne. The young monarch defeated the Turks (1443) in several battles, and advanced to within six days' march of Adrianople. Being afterwards killed in a desperate engagement with the Turks, he was succeeded by his brother Casimir IV. (1445), the most important event of whose reign was the union of the Prussian provinces with Poland. The inhabitants of that rich country, wearied of the oppression of the Teutonic Order, declared themselves (1454) subjects of the crown of Poland. Casimir was an enlightened man, and a great patron of learning.

John Albrecht, who succeeded Casimir in 1492, was a warlike prince, but of a careless and indolent disposition. Under his reign, and that of his successor Alexander, the power of Poland was diminished by the encroachments of the Turks, the Muscovites, and the Tartars. Sigismund, who reigned from 1506 to 1548, was an accomplished, energetic, and successful prince. In his transactions with the emperor, the pope, the czar, the sultan, the Tartars, and his own nobles, he displayed great wisdom and moderation. The troubles produced by the reformation of Luther in the Prussian provinces induced him to repress them by severe measures, which were, however, taken from political motives, and not from any religious intolerance, for on many other occasions Sigismund showed himself very tolerant towards the reformed doctrines.

Sigismund died in 1548, and was succeeded by his son Sigismund Augustus, who died without issue, after a brilliant reign. The Jagellon dynasty then became extinct, and Poland an elective monarchy in practice, instead of being so merely in theory. It was during the reign of Sigismund Augustus that the doctrines of the Reformation acquired a great influence in Poland, particularly among

the higher classes; so that there was a time when its complete triumph was hoped for by the enemies and equally dreaded by the adherents of Rome.

The interregnum produced by the death of Sigismund Augustus (1570) was dangerous to the peace of the country, particularly as the election of a new king was embarrassed by religious differences. Austria, France, Sweden, and Muscovy all put forth candidates. The choice fell on Henry Valois of France; his reign was ended by a somewhat ludicrous flight on his accession to the French throne. His successor, Stephen Bathori or Batory, a native of Hungary, was a valiant and successful king (1575–86). After his death another struggle took place, which ended (in 1587) by the election of Sigismund III., son of the King of Sweden. This king was vacillating and untrustworthy, and involved his kingdom in repeated contests with the neighbouring countries, which were generally unsuccessful.

Sigismund III. died in 1632, in the sixty-sixth year of his age. Bigoted in his attachment to the Roman Catholic Church, he thought more about the conversion of his opponents than about the interests of his country. Protestantism, which was prevalent in many parts of Poland, was almost entirely destroyed by his efforts. His son Wladislaw VII. was elected without opposition. He was a virtuous and enlightened prince, and succeeded in repelling the attacks of the Muscovites and Turks. After his death in 1648 Poland was involved in religious quarrels between the Roman and Greek Catholics, arising from the favours which the Jesuits had received from Sigismund. John Casimir, who reigned from 1648 to 1668, was engaged first in quelling religious contests among his own subjects, and then in repelling Swedes, Muscovites, Cossacks, Tartars, and Turks, all of whom had been in turn invited to assist one or another of the contending parties. He grew weary of his throne, abdicated, and retired to France, where he died in 1672.

Several candidates for the throne of Poland now came forward, but the minor nobility, jealous of the overgrown influence of the magnates, proclaimed as king Michael, Prince Wisniewski, a young man who had no pretensions to so exalted a dignity. His reign was unfortunate, and it required all the brilliant talents of his successor, John Sobieski [see SOBIESKI], to prevent the kingdom from falling to pieces.

Under the succeeding monarchs Poland fell more and more under the power of Russia, while the internal administration of the country was becoming totally disorganized. The constantly increasing power of the equestrian order almost rendered government impossible, and the law was braved with impunity by many of the wealthier nobles, who, although legally on the same footing as the poorer, were as powerful as independent sovereigns.

In 1704 Stanislaus I. was raised to the throne, but the intrigues of his opponents soon compelled him to retire, and the victorious career of Charles XII. of Sweden being disastrously terminated at Pultowa (8th July, 1709), he lost his only powerful supporter. Frederick Augustus I., elector of Saxony, was then elected king by the influence of Russia. He died in 1733, and was succeeded by his son, Frederick Augustus II. On the death of the latter in 1763 an interregnum of some months prevailed. Unhappy Poland was then convulsed by internal commotions fomented by foreign gold. The more patriotic of the Poles rallied sufficiently to bestow the Polish crown on a prince of native birth, Stanislaus II., who displayed considerable capacity and many admirable personal qualities. His abilities, however, were useless, and soon a convenient opportunity arose for the neighbouring powers to gratify their lust of territory. The first partition of Poland, one of the most iniquitous transactions recorded in European history, was effected between Russia, Prussia, and Austria,

on the 5th of August, 1772. Deprived of 82,000 square miles of his finest provinces, Stanislaus still bravely struggled to compose the disorders of his country, until, in 1798, on various pretexts, a second spoliation was consummated, which reduced Poland to an area of only 82,000 square miles. Then, when it was too late, the spirit of the Poles was roused in defence of their rights and liberties. An extensive conspiracy was organized under the leadership of the gallant Kosciusko. The people of Warsaw, which was held by a strong Russian garrison, rose against their oppressors and expelled them. But the peasantry of Kosciusko, with their pikes and scythes, could not long maintain the struggle against the numerous and well-disciplined forces which Russia poured into their country. Suwarow took the command of the Russian army, defeated and captured Kosciusko at the battle of Maciejowice (4th October, 1794), and swept through unhappy Poland with fire and sword. Courland was then annexed to Russia. Stanislaus was compelled to resign his crown, and conveyed as a state prisoner to St. Petersburg, where he died in 1798. A final partition was then effected between Russia, Austria, and Prussia.

Several energetic attempts have been made to throw off the hated yoke since this event in that part of Poland annexed to Russia. Napoleon, on his invasion of Russia in 1812, drew numbers of Poles into the ranks of the Grand Army by the hopes he held out of re-establishing a Polish monarchy, but if he ever seriously entertained such a project, his subsequent fall prevented it from being realized. In 1815 the Allied Powers, at the Congress of Vienna, endeavoured to give a certain show of legality to Russia's usurpations, and to make some provision for the better government of the Poles, by defining the provinces which belonged to Austria and Prussia, by erecting Cracow, with a territory of about 500 square miles, into a republic, and by creating the remainder into a kingdom of Poland, attached to the Russian crown. This last partition divided Poland as follows:—Russia, 220,500 English square miles; Austria, 35,500; and Prussia, 26,000.

It was obviously impossible, however, that the Russian czar, while he ruled as a despot over 50,000,000 of Russians, should reign as a constitutional monarch over 5,000,000 of Poles, and Russia commenced those persistent efforts to destroy the nationality of Poland which she has continued to the present time. The various insurrections of the unhappy Poles have greatly subverted her purposes, by enabling her, under the pretence of re-establishing "law and order," to adopt the most rigorously repressive measures. She has frequently outraged the public opinion of Europe by her cruel policy, which, however, will probably prove successful in the long run.

In the rebellion of 1830–31 the Russians were several times defeated, but finally subdued the insurgents, and inflicted a fearful vengeance. After its suppression the Emperor Nicholas swept away the fiction of a kingdom of Poland, and declared it an integral part of the Russian Empire. Galizia revolted against Austria in 1846, and Austria retaliated by abolishing the republic of Cracow (6th November). The European convulsions of 1848 opened up for a time a vista of hope to the Poles. Prussia and Austria made some concessions in the direction of self-government, but, in the reaction that speedily followed, these were recalled, and things restored to their former footing. In the meantime Russia had been steadily pursuing her policy of "stamping out," and had significantly abolished the line of custom-houses between the kingdom of Poland and Russia proper.

With the accession of Alexander II. to the throne a milder regime was tried, and various reforms in the administration were carried out, but the Poles were clearly given to understand that the connection with Russia would be firmly upheld as it was, and pointed warning was given

against cherishing anything further. It was, however, a separate national life which the Poles had set their hearts on, and without that they cared little for any administrative forms. Accordingly, the ferment of discontent continued to work more actively than ever. In 1860 the people began to assemble in the churches and sing patriotic hymns. In February, 1861, on the anniversary of one of the battles for freedom, a vast procession, numbering, it is said, 60,000 persons, was made to the scene in the vicinity of Warsaw; the Russian troops interfered, and numbers of people were killed. On the anniversary of Kosciusko's death the churches were surrounded with soldiers; yet the people went to them in crowds, sang the forbidden hymns, and refused to disperse. At last the military forcibly cleared the churches, and made numerous arrests. This was declared by the Catholic archbishop to be desecration, and he ordered all the Catholic churches in the city to be closed, an example which was followed by the Protestants and Jews. For this the archbishop was arrested, tried by a court-martial, and condemned to death, a sentence which was commuted for incarceration in a Russian fortress. The chapter of Warsaw refused for a time to name a successor; and it was not till after a lapse of four months (in February, 1862), that the new archbishop allowed the churches to be again opened. In the meantime the people continued to manifest their discontent in every possible way, ceasing to frequent the theatres and other places of public amusement, and breaking out on all occasions in demonstrations, which were followed, of course, by fresh arrests and banishments.

Nevertheless, the emperor resolved to make another attempt at conciliation. His brother, Constantine Nicolaiewich, was sent as viceroy (July, 1862), with a Polish prime-minister; native Poles were appointed governors of the provinces; and several decided ameliorations were initiated. But all these friendly overtures were received as mockery; and the national feeling, which had risen to a frenzy, responded to them in attempts to assassinate the Grand-duke Constantine, the prime-minister, and the commander-in-chief, General Lüders. It now became apparent that what Russia had to contend with was a vast national conspiracy, banded together in the resolution not to rest contented with anything short of an independent national and constitutional government. The conspiracy embraced Posen, Galizia, and other parts of ancient Poland beyond the boundaries of the "kingdom." The crisis was precipitated by an iniquitous and cruel measure. There had been no recruiting of the army since the end of the Crimean War in 1856; and on occasion of the first new conscription for the army secret instructions were given to the authorities in Warsaw to endeavour to make it fall exclusively on that part of the population that had contributed chiefly to the political disturbances; those especially were to be chosen who had received "bad marks" as disaffected. Students were no longer to be exempt as heretofore; and more recruits, in proportion, were to be drawn from the towns than from the rural districts. In short, the cultivated part of the population was to be struck at, for it was among them that the national feeling was chiefly fostered. Accordingly, throughout Poland, on the 15th of January, 1863, in the early morning, while it was yet dark, soldiers burst into the houses of the individuals thus arbitrarily fixed upon, and dragged them off to serve in the army. But great numbers of young men, knowing what was coming, had previously left their homes, and taken refuge in the forests. These now gathered in armed bands; the secret committee of Warsaw came forward as a provisional national government and issued a proclamation calling the Polish people to arms; numbers of expatriated Poles and volunteers hastened to the conflict from all the countries of Europe, and the whole kingdom was soon overspread with insurrectionary corps. They never suc-

ceeded, however, in forming anything like a powerful, well-organized army, and notwithstanding prodigies of valour, no decided impression was made on the Russian forces. A kind of dictatorship had at first been conferred on Mieroslawski, but he was soon obliged to take refuge beyond the frontier, and Langiewicz, who succeeded him, fared no better.

The secret committee again (May) took the direction of affairs, and declared against any more dictators. The sway which this secret National Government, as it styled itself, was able to exercise for a time was something wonderful. All efforts of the Russian authorities to discover where it was located were fruitless, and yet its action was everywhere seen. Its orders were publicly announced, and a formal government gazette expounded its views. Its commands were everywhere implicitly obeyed. It was a real reign of terror, and although Poland was bristling with Russian bayonets the Russian government was far less powerful to secure obedience.

At length the Russian government, despairing of conciliation, resolved on the sternest repression. Constantine gave up his mission (August, 1863), and returned to St. Petersburg, and General Berg proceeded to carry out the new policy with unrelenting vigour. In this, however, he was far exceeded by General Muraviev, military governor of Lithuania, who, by the ruthless measures with which he ruined and crushed the Polish nobility of that province, raised a cry of execration throughout Europe. All over the Polish area there was nothing but arrests, banishments, executions, confiscations, and enforced contributions; and severe punishments were inflicted for wearing mourning. But the most effective step towards the extinction of the rebellion was when, by an imperial ukase, the peasants were made absolute proprietors of the lands which they had hitherto occupied as tenants. The government undertook to indemnify the landowners for the loss of their revenues, and thus made them dependent upon its good will for their very subsistence, while the peasantry now willingly assisted the troops in hunting down the insurrectionary corps. In February, 1864, the secret government began to cease its activity, and the insurrection might be said to be extinct. During the struggle the European powers recommended the czar to grant various concessions, in accordance with the treaty of 1816, but as they forbore to strengthen their recommendations by a display of armed force they were coolly put aside. It was estimated that during the struggle upwards of 50,000 men were slain in the field or on the scaffold, and fully 100,000 despatched as exiles to Siberia. In 1868 a ukase was issued, designating Poland the "Vistula Province," abolishing all internal government, and proclaiming a complete union with the Russian Empire. There still remained one link which just reminded Poles of their distinctive nationality, in the fact that General Berg retained the title of lieutenant or viceroy of Poland, conferred upon him after the insurrection of 1863 had been quelled. Count Berg, however, died in 1874, and no successor to the title was appointed.

POLANISIA is a genus of plants belonging to the order CAPPARIDACEÆ. The species are herbaceous plants, natives of the warmer parts of Asia and America, with palmate leaves and terminal clusters of flowers. *Polanisia icosandra*, a native of the East Indies, is used in Cochin China as a counter-irritant in the same way as sinapisms in Europe, and as a vesicant. The leaves have an acrid, pungent taste, and are used for salads. *Polanisia graveolens* is a native of North America, and is employed as a vermifuge. The leaves of another species, *Polanisia felina*, are used in India as a tonic and expectorant.

POLAR BEAR. See BEAR.

POLAR REGIONS and **POLAR VOYAGES.** The geographical poles are those points upon the globe's surface which form the extremities of the imaginary axis

of the earth in its daily motion. The regions around these points within $23\frac{1}{2}$ degrees of latitude are included, in the north, under the name of the Arctic Circle; and in the south, under that of the Antarctic Circle. The term Polar Regions embraces these circles together with the regions around, which are distinctly characterized by the like extreme climate. This climate, owing to the position of the polar circles in regard to the sun, is marked by cold to a degree almost destructive of life, and offers the most terrible obstacles to exploration. Still the desire to be the first to unravel problems of interest to the whole world, the importance of opening new trade routes, and latterly the increasing belief that a more thorough knowledge of the physical condition of the globe will be of practical value in the study of the atmosphere and its disturbances, have led to numerous expeditions, nearly all of which have been attended with privation and danger, and often with death under the most painful circumstances. These expeditions have done much to dissipate the mysteries of the frozen lands, and have certainly destroyed the golden dreams of limitless wealth and fertile soils hidden within the grasp of the ice-king, in which hopeful imaginations formerly indulged. It may also be said that the further exploration is carried, the more clearly, from the business point of view, is the practical uselessness of it demonstrated.

NORTH POLAR EXPEDITIONS.—At the earliest dawn of history we are told that the Arctic regions were supposed to be the realm of perpetual night, where, upon the borders of a vast sea, the Cimmerians dwelt in the congenial gloom; and about the earliest definite statement which has come down to us is that of Scymnus Chius, who flourished between 90 and 76 B.C., and who says, in his "Fragments," that "at the extremity of the Celts is a boreal peak; it is very high and sends out a cape into a stormy sea." It is, however, remarkable that references occur to the phenomena of high northern latitudes which must have either been deduced by reasoning from facts observed elsewhere, or supplied to northern voyagers by those with whom they communicated. Thus the sea is said to be languid and nearly motionless in that direction; the sun is described as neither rising nor setting, but going round the horizon; and the figures of the gods are affirmed to appear there covered with luminous beams. These are evidently allusions to the ice-bound ocean, and the long summer day of the polar circle, with the brilliant coruscations of the aurora borealis. During the next 1300 years little was done in the way of northern exploration, except in the direction of Greenland and Iceland; but "monks of old," who were bold and skillful sailors, pushing far out to sea in boats of wicker and hide, seem to have sailed northward from Iceland till they found the sea frozen. In the thirteenth and fourteenth centuries maritime activity seems to have developed, and we find Edward III. maintaining a fleet for service in the "parts boreal." The ancient manuscript records of Lynn contain a reference to "armour for the use of the North Fleet," which is suggestive of encounters with ice; but it is probable that its principal use was to protect fishermen and traders in attacks from the northern pirates. However this may have been, it is certain that by the beginning of the sixteenth century the "parts boreal" had assumed definite shape and form, the magnetic pole being actually laid down in the map appended to the edition of "Ptolemy" published at Rome in 1608. And on the margin of this map is a legend which has been translated in the following terms:—

"It is written in the book of the 'Fortunate Discovery' that under the Arctic Pole there is a high magnetic rock, 83 German miles in circumference. This is surrounded by the fluid eugenum sea, that, as a vase, pours out water by four mouths from below. Around are islands, of which two are inhabited. Mountains vast and wide surround these islands, twenty-four of which deny habitation to man."

This legend held till 1659, though doubts are thrown upon it by Blundeville in 1589. With the discoveries of the end of the fifteenth and of the sixteenth centuries came more definite and correct geographical ideas, and an expedition was despatched from England in 1553 to discover a passage to Asia through the northern seas [see NORTH-EAST AND NORTH-WEST PASSAGES], and to discover strange countries. Chancellor, with one ship, entered the White Sea, and, on landing, his crew were sent to Moscow, where they were well received by the Czar, Ivan the Terrible. Various voyages in search of the north-east passage led to the discovery of the strait between Novaya Zemlya and the Isle of Waigat leading into the Kara Sea (Spitzbergen), Frobisher's Strait, and the inlet into Hudson Bay. The news brought by Frobisher's expedition of the finding of the precious metals led to an expedition in 1577 in search of it. In the following year another fleet followed. It is almost needless to say failure attended both. In 1583 Sir Humphrey Gilbert reached Newfoundland, and a survey was made for a colony. The weather on the return was terrible, and the admiral's ship was suddenly lost. Several voyages were now made by John Davis, in the course of which he reached lat. $72^{\circ} 41' N.$ and discovered Cumberland Strait and Baffin's Bay. In an expedition of 1610, in which Hudson met his cruel fate, he discovered the great bay which now bears his name. About this time the Spitzbergen whale fishery commenced, and some Danish expeditions sought the supposed lost Greenland colony. Expeditions leading to the further exploration of Hudson Bay now sailed under Bietton, Lylot and Baffin, Fox, and others, until the establishment of the Hudson Bay Company in 1670. During the eighteenth century the Dutch whalers succeeded in attaining very high latitudes, whilst the Russians made progress along the northern Asiatic shores. In 1728 an expedition sailed from the river of Kamtchatka, under Behring, who ascertained the separation of Asia from America; but either from unfavourable weather, or from keeping close to the Asiatic shore, he never caught sight of the American coast. This was reserved for Krupishef, a Cossack, who sailed from Kamtchatka in 1781, in order to co-operate with a land expedition into the country of the Tchouktski. Forced by a gale of wind from the point of land where Behring's voyage had terminated, and driven to the eastward, he found, first an island, and then a country of great extent. This completed the discovery of the strait by observation of both sides of the channel; and the fact of the proximity of the continents was added to that of their separation. In 1770 Lachow, an obscure fur-trader, by sledging across the frozen seas, discovered New Siberia, where hills of fossil-wood line the shores, while immense tracts, even whole islands, are composed of the tusks and bones of mammoths, rhinoceroses, and other extinct pachyderms, rolled in sand, gravel, or alluvial earth, cemented by ice.

In 1778 an expedition was despatched to reach the North Pole, if possible, under Captain Phipps, but the highest point attained was $80^{\circ} 48' N.$ latitude. Captain Cook's voyage of 1778 was to search for a passage from the Pacific to the Atlantic in the north. In 1806 the celebrated Captain Scoresby, in one of his whaling voyages, attained the highest latitude yet reached, $81^{\circ} 30'$. Two expeditions for the North Pole sailed in 1818, one under Captain Buchan, and the other under Captain Ross, but neither succeeded in making much progress. In the following year an expedition sailed under Parry, which attained $74^{\circ} 26' 25''$ latitude, and $113^{\circ} 46' 43''$ longitude. Two more voyages under the same commander, in 1821 and 1824-25, led to little success, but an expedition under Captain Beechey obtained extended information in the vicinity of Behring's Strait. In the meantime two land expeditions started to examine the polar coast of North America. The experience of Captain Scoresby

had led him to suggest a means of reaching the Pole, which has played an important part in all subsequent expeditions. It was that as high a point as possible should be reached in ships, and that sledges should then push on as far as possible over the frozen seas. The first expedition to use this method sailed in 1827, under Parry, and resulted in the latitude of $82^{\circ} 45'$ being gained. Further progress was arrested by the southern drift of the ice ground itself.

An important result was obtained by an expedition under Ross, which started in 1829. This was a near approach to the North Magnetic Pole, on the west coast of Boothia. The amount of the dip of the magnetic needle was here $89^{\circ} 59'$, being only one minute less than 90° , the vertical position, which would have precisely indicated the polar station. The exploration of the whole North American coast-line was rendered complete in continuation of Ross's work, by the journeys of Captain Back, and Messrs. Dease, Simpson, and Rae, officers in the service of the Hudson Bay Company in 1853.

In the year 1845, contrary to the judgment of very many, who thought sufficient hazard of life had been incurred in attempts to effect the North-west Passage of America, the government determined to make a further effort to solve, if possible, a geographical problem certainly of interest, but of no practical importance. The task was intrusted to Sir John Franklin in the *Erebus*, as commander, a veteran in polar service, who had for his second Captain Crozier, in the *Terror*, likewise an officer of great experience in the navigation of icy seas. They left Sheerness in May, 1845, and were last seen on 26th July, by the captain of a whaler, waiting an opening in the middle ice of Baffin's Bay to cross through it to Lancaster Sound. The veil then dropped over the hapless *Erebus* and *Terror*, and what became of them and their crews was not known, though surmised, for fourteen years. Expedition after expedition was sent out to ascertain their fate, and the resources of government and the munificence of private individuals, both in England and abroad, were brought to bear upon the object. In the intervals between 1818 and 1854 inclusive, twenty-four vessels sailed, and two land-journeys were made. The world never witnessed before a spectacle so exciting in its circumstances and scene as this long and arduous search, so full of wild grandeur and profound pathos. Countrymen and strangers invaded the dark depths of polar night, in the struggle to reach the lost. Friend yearned after friend, and brother strove to get at brother, amid the congealed masses of the ocean, with an ardour which no cold could chill or danger appal. The dreary solitudes of the Arctic zone were converted into a vast hunting-ground; and the voices of anxious bands roused its echoes, now cheering on each other in the endeavour to find the prison-house of the vanished crews, and now talking over their own perils, plans, hopes, fears, and hairbreadth escapes. Regions naturally desolate of human life were traversed by many a party intent upon the task of meeting with the trail of Franklin amid the bear-tracks of the north, rescuing any of the forlorn survivors, or wresting from the stern keeping of the ice-fields the secret of their fate, and honouring their remains.

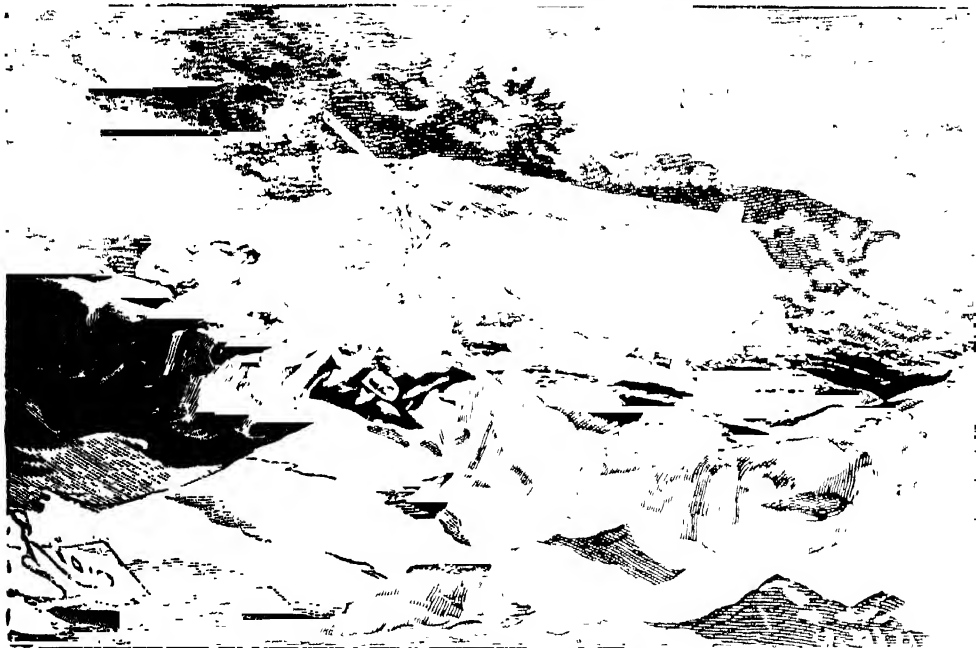
The first trace of the Franklin expedition which was discovered left its fate in complete obscurity. It was the good fortune of Captain Ommaney, in the *Assistance*, to fall in with significant, though tantalizing, memorials of it. This was on the 28rd of August, 1850, at Cape Riley, and Beechy Island adjoining, on the eastern side of the entrance to Wellington Channel. At the former site, a high bluff headland, five tents had evidently been pitched; remains of human food were scattered about; and a piece of rope was found with the well-known Admiralty mark of a yellow strand. As no one had landed there since Parry sent an officer on shore to make observations in 1819, it was

year 1880, where two headlands within sight were named by him Cape Franklin and Cape Jane Franklin. The results of the searches after the Franklin expedition led to an immense increase in polar knowledge, and to the discovery of over 7000 miles of coast.

Since 1859, in addition to English and American, there have been successively Swedish, German, Austrian, and Dutch expeditions, and of these probably the Swedish have been the most persevering and successful of all. Between 1858 and 1872 Sweden sent no less than seven scientific expeditions to Spitzbergen, and two to Greenland. * In each of these Professor Nordenskiöld took a leading part, first as geologist, then as scientific assistant, and lastly as commander. The most valuable information was gained, and in 1868 the high latitude of $81^{\circ} 42' N.$ was reached. The efforts of German explorers have also been directed chiefly to Greenland. Their plan was to take advantage of the most favourable part of the season to effect landings on the eastern coast, and to pursue this

year after year until the utmost possible northern latitude was reached. The first expedition was in 1868, when the *Germania* sailed from Bergen. Unable to approach the east coast, the *Germania* made for the Spitzbergen seas, and returned to Bergen. The second German expedition left Bergen in 1869. It consisted of a screw steamer of 140 tons re-named the *Germania*, with the brig *Hansa* as consort and storeship. The *Hansa* was early crushed, and the crew only escaped after a dangerous voyage on an ice floe. The crew of the *Germania*, by sledging, reached the latitude of 77° , and explored an extensive fiord stretching for a long distance into the interior of Greenland, finding upon its shores peaks (Petermann's and Payer's) respectively 14,000 and 7000 feet high. The long accepted idea of a supposed colony has been conclusively shown to be an illusion, arising from an error in one of the earlier maps.

An attempt at Polar exploration by way of Smith Sound was made by Captain Hall, of the United States, who in



Crew of the *Polaris* on an Ice Floe.

1869 returned from an expedition of five consecutive years in the Arctic regions, where he lived like one of the Eskimos, inured himself to their mode of life, and acquired their language. The expedition left in the *Polaris* in June, 1871, and almost without a check from ice reached latitude $82^{\circ} 16' N.$ a higher latitude than had ever before been attained by any ship, and within 30 miles of the most northern point ever reached by civilized men. Here the *Polaris* first encountered ice, and the sailing captain immediately induced Hall to take shelter at the nearest anchorage, to do which he retraced his journey back to $81^{\circ} 38' N.$ In October Captain Hall went out with a travelling party, but did not get beyond the eighty-second parallel. On his return he was taken ill, and died on the 8th November. The expedition became, at his death, entirely disorganized; and as Budington, the sailing captain, possessed but little qualification or taste for exploration, nothing further was done in 1872, although the prospect was most encouraging. In August of that year, as soon as the *Polaris* was once more free, her head was turned southwards.

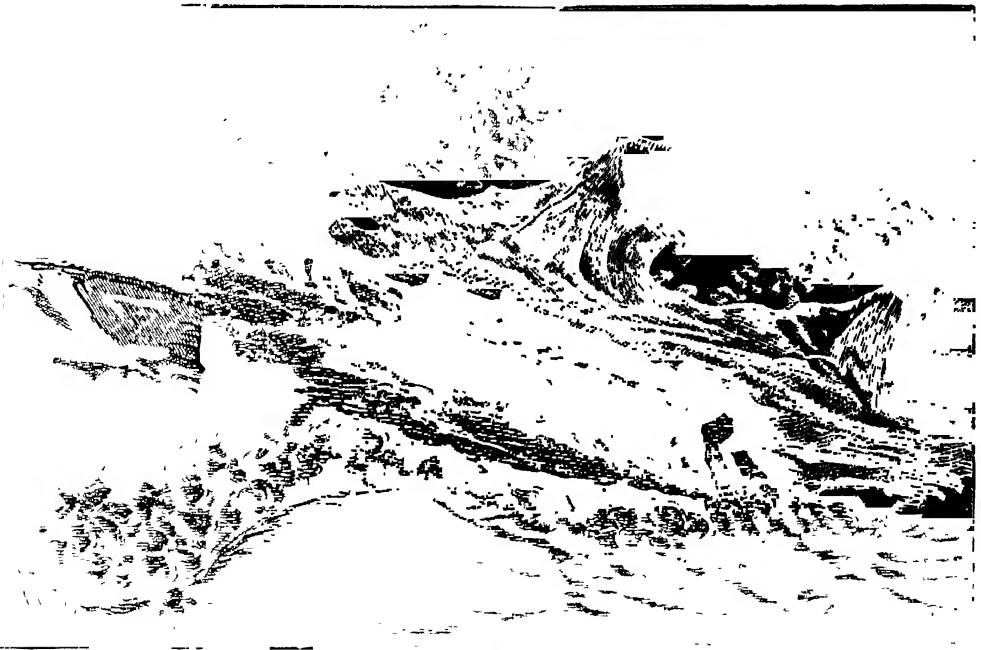
The voyage home was fruitful in adventure and in some misfortune. On the 15th October, when off the north entrance to Whale Sound ($77^{\circ} 53' N.$), the vessel was so severely "nipped" that preparations were made to abandon it. Boats and provisions were got out on the ice, and about half the crew had left the ship, when suddenly the ice opened and the ship became free, but those on the ice were carried away with the floe. On this they drifted about all the winter, suffering at times great privations, and with the often unpleasantly imminent prospect of their ice raft letting them into the sea, as in a more southerly latitude its dimensions fast diminished. At last, after drifting the whole length of Baffin Sea, Davis Strait, and down the Atlantic to $53^{\circ} 35' N.$, they were picked up by the *Tigress*, 40 miles off the Labrador coast, and taken to St. John's, Newfoundland. This was on the 29th April, 1878, between which date and the previous October they must have been carried a distance of at least 1600 miles. The *Polaris* itself, by repeated nippings, had become so disabled that it was necessary to beach her speedily, which was done in a

small bay at the entrance to Whale Sound. With the help of the friendly Eskimos, who provided them with malodorous but most acceptable supplies of clothing made of skins, the party passed the winter tolerably well. Towards its end they commenced building two boats out of the timbers of the *Polaris*, pursuing their labours with the thermometer 23 degrees below zero, and with generally a blinding drift. The situation was one that might have daunted the strongest hearts, but that life depended on the effort. At the end of June, 1878, the boats were ready, and proved very successful; for, though very leaky, they sailed well and were easy to pull. Going with the stream, they had no great difficulty in reaching Cape York, where they were picked up by a whaling ship and carried to Dundee.

Although no effort was made by Captain Buddington, after Hall's death, to effect the purpose of the expedition, the results of the *Polaris*' voyage were of much interest. The unexpectedly high latitude attained by the vessel gave great hopes of what might be effected by an expedition

stronger and better equipped. Animal life was found in abundance near the winter-quarters, only about 500 miles from the Pole; the climate was declared to be milder than further south; and the ice of the sea comparatively open. Another significant fact was that drift wood was picked up in the extreme position reached, coming down from the direction of the Pole.

One of the most important discoveries made by modern voyagers in the far north must be credited to Austro-Hungary, as worthily represented by Lieutenants Weyprecht and Payer, who sailed from the Elbe in June, 1872, in the *Tegethoff*, with the object of discovering a North-east Passage. Early in August, near the coast of Novaya Zemlya, the ice began to gather round the vessel, and she became hopelessly encompassed and locked in. A brave fight was made by sawing and blasting; but in an incredibly short time the sundered pieces froze together again, and Weyprecht and Payer were apparently doomed to be no longer discoverers, but to remain as helpless voyagers on a floe of



Return from Franz Joseph Land.

drifting ice. For six months the *Tegethoff* drifted steadily in a north-eastern direction to 73° E. lon., and then north-west. For another six months the ice-bound vessel was thus slowly carried; when, on the 31st August, 1873, the explorers were surprised by the sudden appearance, a few miles to the northward, of a mountainous country. Anxieties and toils were soon forgotten, as the voyagers found themselves almost within reach of a new Polar land rich with the promise of discoveries. Soon after October began, the floe in which the *Tegethoff* was locked was driven upon the land, where it froze fast. Another winter was passed on the ice, and in the spring of 1874 Lieutenants Payer and Weyprecht made sledge expeditions along the newly discovered land towards the north and west. It was named Franz Joseph Land, in honour of the Austro-Hungarian monarch. The mainland was divided by a wide sound—Austria Sound. Up this inlet and over the land the explorers penetrated to the parallel of 82° 51' N., and land was clearly seen extending as far as the imposing Cape Vienna, in latitude 83° N. Many bears were killed,

but no other quadrupeds were met with, and the flora was exceedingly poor. A large portion of the land is covered with immense glaciers. The conical peaks of the hills rise above the plateau to a height of 5000 feet. The country was found to extend through 15 degrees of longitude, but is probably of much greater extent, as its termination could not be seen from the summits of the mountains.

Returning to their vessel, the explorers found the *Tegethoff* still hopelessly beset, and it became necessary to contemplate her abandonment. One man had already fallen a victim to the hardship and rigour of the enterprise, and the party were but ill provided for a third winter. On the 20th May, 1874, therefore, the flags were reluctantly nailed to the mast, and Weyprecht and Payer with their little band started southward over the ice. Reaching the edge of the land-ice, they had to clamber with boats and sledges from floe to floe, now and then taking to their boats to cross the open fissures. As often as they advanced they were driven back by southerly winds, so that after two months of incessant labour they were still only

about 7 miles from the ship. After many hairbreadth escapes, however, they fell in with a Russian schooner on the 24th August, and reached Vardoo in Norway, on the 3rd September, 1874.

The most complete expedition that had yet sailed for Arctic regions was despatched by the British government in 1876, under the command of Captain (now Sir) George Nares, with Commander Markham as second. The vessels—named the *Discovery* and *Alert*—left Portsmouth on 29th May, and on 1st September the *Alert* had reached latitude $82^{\circ} 20' N.$ —a more northerly position than any vessel had ever before attained, and the ensign was hoisted at the peak amid general rejoicings. With a favourable wind Captain Nares had sanguine hopes of attaining to latitude $84^{\circ} 20' N.$ Soon afterwards, however, the northward progress was arrested. The pack was slowly nearing the shore, and to protect his vessel Captain Nares ran the *Alert* inside some large pieces of ice lying aground close to the beach. Other gigantic pieces of floe-ice, “floe-bergs,” as they were termed, soon ran aground in about 70 feet of water at the rear of the *Alert*, and the leading vessel of the Arctic expedition became imprisoned for the winter.

The winter was passed with as little discomfort as could be expected, with the thermometer sometimes at 105° below freezing point, and it being necessary to economize coal. On the 4th of March the temperature of 106° below freezing point was registered, being the lowest experienced by the expedition, and in fact the lowest really authentic observation ever registered in any part of the world. At this extraordinary degree of cold, glycerine—upon which 80 degrees below freezing point had little effect—became perfectly solid and transparent. Rectified spirits of wine became of the consistency of hair-oil. Concentrated rum, 40 degrees over-proof, froze hard when exposed in a saucer; and when in a large and deeper quantity, it resembled honey or molasses in consistency. Whisky froze hard, and some pieces were actually broken off and eaten by the men. Chloroform was the only substance on which the low temperature had no apparent effect.

On the 3rd April, 1876, three sledging parties started for exploration of the surrounding country. The temperature on the day of starting was 77 degrees below freezing point—a cold so intense as to prevent sleep in spite of the weariness induced by a hard and toilsome day's work. The rugged nature of the ice over which each party had to travel, and the heavy weights to be dragged, rendered progress slow and tedious. The men of the expedition had every one been carefully picked with a view to robust health and physical endurance, and a finer company never served under the British flag. The sledging journeys, however, put their qualities of endurance to the most stringent test, under which, unfortunately, several brave fellows succumbed. This was not due particularly to the cold, though the severity of a temperature 105 degrees below freezing point can scarcely be realized by those who have not experienced it. Had the travelling been of the ideal kind, with dog-sledges careering gaily over a smooth though snowy surface, the riders only dismounting to cook or encamp, the North Pole or any other given destination would have been gained, spite of any amount of cold. But as a matter of fact dogs were but of little use in the face of the obstacles to be overcome. In the case of the northern journey more especially, a few hundred yards of fairly level surface was the exception; the rule, that the course lay over or through great “hummocks” of ice from 20 to 63 feet high, the depressions between being filled with snow (which fell abundantly during the journeys) scored into ridges by the wind. Over all this uneven surface the direction had first to be marked out by advance parties, then the ice levelled or cut through by a detachment with pickaxes and shovels. When these had done their best, the “road” was often such that advance was impossible

without unloading or lightening the sledges and first taking them across, then carrying over the loads by hand. Sometimes, by immense exertions, the sledges were dragged up and over the hummocks, and the labour this involved may be conceived by the fact, that along fairly even surface it was frequently only possible to move a sledge by the whole party facing it, and with united hauls pulling it forward a few feet at a time. The appearance of the palæocrystic sea, or sea of ancient ice, may be compared to an ocean frozen in a moment of boisterous tempest; and the course of the northern sledges was something like advancing over and through a multitude of icebergs, with an occasional plateau of snow, which concealed many a treacherous gap, into which men suddenly sank in water up to the chest. If the snow was only up to the knees, the upper layer or crust was so frozen that the men could not force their legs through it, but had to go through the exhausting process of lifting them straight out of the holes at each step. The “advance” could often get on best by crawling on their hands and knees, and by even dragging the sledges thus. In the greater portion of the journey it took the whole party to drag one sledge; and what with cutting or quarrying out the road, dragging the three sledges in turn, and sometimes taking off and carrying the contents of the sledges separately, many weary toilsome miles were traversed before a single one was made good.

It was not so much the extreme cold as this fearfully arduous and exhausting work, with broken and comfortless rest, with everything consumable having to undergo a tedious process of thawing, and an entire absence of fresh provisions, owing to having got beyond the latitude of living animals, which naturally told on the hardy physique of the explorers. One after another of them sickened; first of all became useless for dragging, and ultimately had to be themselves placed on the sledges, and drawn along by their less exhausted comrades. With magnificent pluck each party pushed forward to the utmost extent of endurance, and indeed considerably beyond the point at which prudence counselled a return, owing to failure of both strength and provisions. The result was that each of the three detachments was within an ace of being entirely lost. Two men succumbed to scurvy in the eastern party, and one in the northern; and probably very few men of either the northern, eastern, or western detachments would ever have reached the ships again, but for the timely arrival of relief parties. The northern sledge, on its return, halted at 40 miles from the *Alert*, all scurvy-stricken except Commander Markham and Lieutenant Parr. Further advance was impossible, and the case looked serious. Lieutenant Parr (who had himself lost a great toe through frost-bite) nobly volunteered to make his way to the *Alert* for help, and his solitary Arctic tramp of 40 miles through snow and ice, at the imminent risk of his own life, was one of the finest and most heroic incidents of the whole expedition. He reached the *Alert* in twenty-four hours, and help was despatched in time to save all the party but one.

It was on the 12th May, 1876, that observations showed Commander Markham his party had reached the latitude of $83^{\circ} 20' 26'' N.$, or exactly within 399½ miles of the North Pole—a nearer approach, by many miles, than had ever been attained by any human being. [See Map of the Polar Regions prefixed to this volume.] The state of the provisions, together with the fact that three of his party were helpless invalids upon the sledges, and that four others showed unmistakable symptoms of the disease so dreaded by Arctic travellers, warned him that the time had fully arrived to return. As a matter of fact, he was only 73 miles from the ship; but to attain this trifling distance his party had marched no less than 318 statute miles, and there was the same weary distance to be got over before any adequate comfort or medical aid was obtainable for the sick. On the 13th May, therefore, the halt was called,

and the vessel was reached on 14th June, after an absence of seventy-two days.

The experience of the western and eastern parties was, to some extent, similar to that of the northern as regards the travelling; great pressed-up hummocks of ice barring the way in every direction, and both parties—eager to achieve the utmost possible results—having pushed onwards to a dangerous distance from their base. There was, however, the difference between these and the northern division, that both eastern and western parties were following a line of coast, and with this advantage they were able to extend their research to a much greater distance from the *Alert*. On returning, the western division was fortunately met by a relieving party just in time to save from complete exhaustion the last one or two men who were able to hold on to the drag ropes, and no loss of life occurred, although scurvy had attacked nearly all. The eastern expedition was not so fortunate, two brave fellows being left behind in an icy grave, and the whole party barely escaping with their lives. The western party succeeded in exploring the northern coast of Grant Land for a distance of 220 miles, during eighty-four days' absence from the ship; their travelling in that time amounting altogether to 725 miles. In lon. $70^{\circ} 30'$ W. they rounded Cape Columbia, which is the most northern known land, being situated in lat. $83^{\circ} 7'$ N. Westward of this the land trended south, and from the explorers' extreme point to Patrick's Island there remains a line of 400 miles yet unexplored. The eastern division met with difficulties more severely trying in their nature than either party, although the mileage marched over (453

miles) was not so great. They were 132 days absent from their ship, and explored the northern coast of Greenland for a linear distance of 80 miles, from which point they saw beyond them an extended headland named Cape Britannia. Between this cape and the point on the further or eastern coast reached by Koldewey in 1869 there remains a distance of 500 miles unexplored.

Captain Nares considered it would be impossible to achieve any further success which would justify him in remaining another winter in the same latitude, and on the 31st July, 1876, the return voyage was commenced, the vessels arriving in Portsmouth harbour on the 2nd November, after an absence of one year and five months.

In 1878 Holland commenced despatching a yearly expedition to Arctic regions. Franz Joseph Land had now become a centre of interest to Arctic explorers. The Dutch came within sight of it in 1879, Captain Markham attempted to reach it without success in the same year; but Mr. Leigh Smith landed and explored 105 miles of the south-western coast, besides rounding the extreme western point, and ascertaining that the land trended northward with a westerly aspect. He found that in several places there were anchorages with good shelter and holding ground, where a steamer could wait for opportunities to pass northward. Another expedition under Mr. Smith sailed in the following year, but the vessel was lost, and the party was brought home in 1882 by the *Hope*, under Sir Allan Young.

At a conference held at Hamburg in 1879, at the suggestion of Lieutenant Weyprecht, it was decided to establish a systematic examination of both North and South Polar



Cape Washington: the "Furthest North" of Greely's Expedition, 1882, and the highest point yet reached.

Regions by means of parties sent out by various nations, who would take synchronous observations. As a result, in 1882 Denmark was established at Godthaab; America in Lady Franklin Bay, in Smith Sound (the northernmost of all the stations); Germany in Cumberland Sound, on the west side of Davis Strait; and England at Fort Rae, in the heart of the Hudson Bay Territory, near the Great Slave Lake. America had also a station at Point Barrow, Russia occupied the mouth of the Lena; Norway was installed at Bosekop, in the Alten Fjord; Sweden selected Spitzbergen; and Austria garrisoned Jan Mayen Island. The Finnish Landdag fitted up a meteorological station at Sodankyla, and Germany also established an assistant station in Labrador. France established a station near Cape Horn, and Germany took the southern hemisphere in

hand, her third party being installed on one of the islands of South Georgia, in $54^{\circ} 30'$ S. lat., $41^{\circ} 20' 15''$ W. lon., some 1100 miles east of Cape Horn.

In the establishment and relief of these stations upwards of 700 men incurred the dangers incident to all Arctic service, but such has been the improvement in Arctic exploration that save in the American expedition to Lady Franklin Bay in Smith Sound, no man perished. The command of this important expedition was given to Lieutenant (now Major) Greely, of the United States army (who had volunteered for the service), and he had under him two second lieutenants, one surgeon, and twenty-one enlisted men, all belonging to the army. In explanation of the selection of men from the army, it should be remembered that the explorations required

of it were to be on land, and a permanent land station was to be established close to a seam of coal discovered by the English in 1875.

It was arranged that a whaler should convey the party to their destination, but should not be detained during the winter; the United States Government undertaking to send a vessel with supplies, &c., in 1882, and again in 1883, which, if unable to reach Lady Franklin Bay, was to land provisions on the east coast of Grinnell Land, and leave notice of such deposit at various points.

During the first year a very considerable amount of exploring work was accomplished. Depots were planted at various points round the east coast of Grinnell Land, and preparations made for the work to be carried out in the spring and summer of 1882. The most important part of this work was the exploration of the North Greenland coast by Mr. Lockwood and party, who succeeded in attaining Cape Washington, in latitude $88^{\circ} 24'$, about 4 miles further north than that reached by Captain Markham in the Nares expedition, and the highest point at present known. It should, however, be remembered that in Lockwood's case the journey was made along the edge of a coast, while Captain Markham's party struck boldly out into the waste of "palæocrystic" ice. But Lockwood's trying journey was in every way praiseworthy and successful, and it is much to be regretted that he afterwards succumbed to the terrible privations endured by the expedition. The coast visited by Lockwood is like that further south, broken up by fiords, and the interior, so far as could be seen, is a waste of undulating snow. There are now only a few degrees remaining to complete the survey of the coast-line of North Greenland, by uniting the explorations of east and west.

Perhaps the most important and interesting work accomplished in the spring and summer of 1882 was that by Lieut. Greely himself in the interior of Grinnell Land. Here he verified in a very remarkable way the conjecture of Sir Joseph Hooker in 1877, from the facts then known concerning Grinnell Land, that, like Greenland, it is not an ice-capped, but an ice-girt island. So, in fact, did Lieut. Greely and Mr. Lockwood find it to be the case. Between a little north of 81° and 82° , and between $65^{\circ} 30'$ and 80° W., we have an Arctic oasis, in which even in April Lieut. Greely found little snow. On its northern edge is Lake Hazen, a large sheet of fresh water, around which are numerous smaller lakes discharging into it. In April, too, Lieut. Greely found one river at least quite open. The valleys give birth to a comparatively luxuriant vegetation, which serves as pasturage for considerable game. Its northern borders are bounded by the Conger and United States Mountains, through which breaks a magnificent glacier, abutting on Lake Hazen, with a convex face some 5 miles long and over 150 feet high, an outlier of the great ice-cap which covers all the north of Grinnell Land. Returning again in June for further exploration, he found the vegetation luxuriant and animal life abundant. Besides grass in plenty, willows, beds of dryas, and saxifrages were common; butterflies were numerous, and bumble-bees and "devil's darning-needles" flitted about. Ample remains of recent Eskimo settlements were found, and fossil testimonies to the former temperate character of the climate, and the recent elevation of the whole land. Temperatures almost oppressive were experienced on this journey, rising to 74° Fahr. on one occasion in the shade. On another occasion, in the end of June, the temperature in the shade was 64° , while at Fort Conger it was only 51.2° , thus confirming the observations of the Nares expedition. In the spring of 1883 Lockwood and Brainard penetrated westward along the south edge of the oasis, and came out on Greely Fiord, which cuts far into the west of Grinnell Land.

The fiords which stretch westwards from Lady Franklin Bay were carefully explored and accurately laid down, and

much other subsidiary work done during the long stay of the expedition at Fort Conger. During all this time the health of the expedition was wonderful, with no traces of scurvy. Lieutenant Greely gave careful attention to dietary, and his experience will be of service to future expeditions.

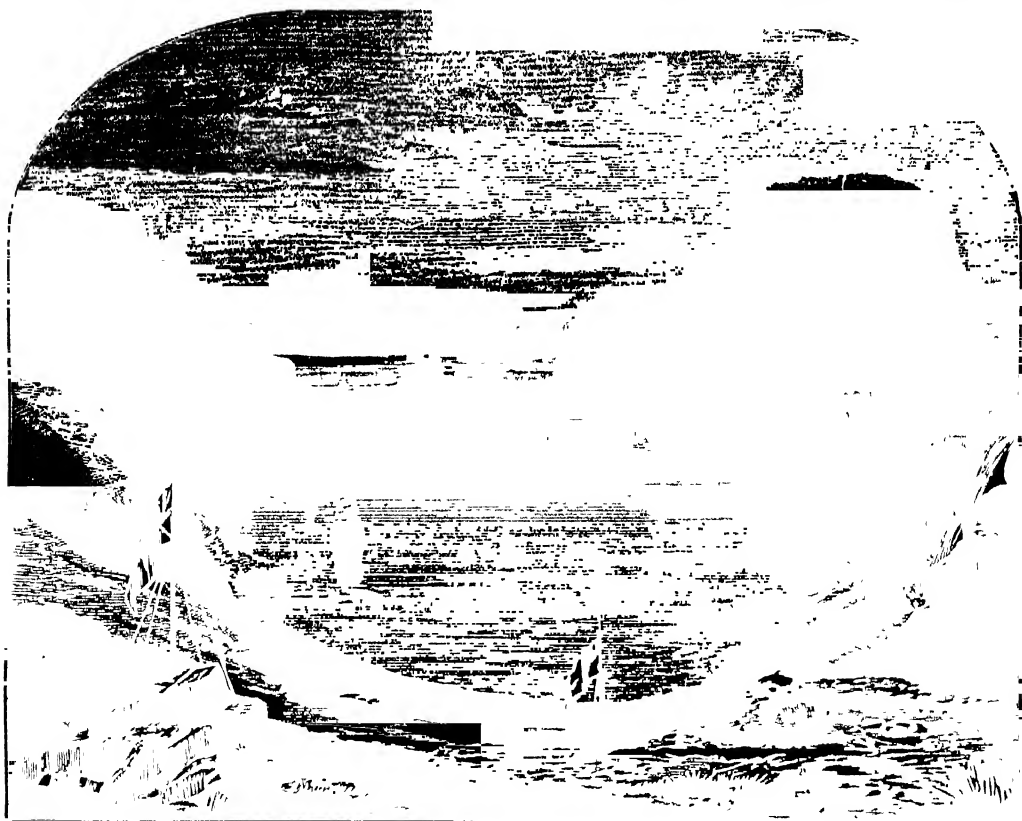
The vessel which had been sent to the station in 1882 was wrecked, and, in obedience to his orders, on 9th August, 1883, Lieutenant Greely commenced his disastrous retreat by boat. The sufferings endured—which ultimately led to the death of most of the party—can to some extent be realized in Lieutenant Greely's two painful but intensely interesting volumes, "Three Years of Arctic Service" (London, 1886). Starting in a steam launch and three small boats, with such provisions as they were able to carry, they soon got nipped by the ice, and were carried by an ice-floe for nineteen days. At last they had to abandon the steam launch, and drag the boats over the ice, reaching the shore with great difficulty. After fifty-one days and 500 miles of travel they landed near Cape Sabine. From this time the record of the party is one of daily increasing wretchedness and starvation. On 9th October they found a record of the loss of the *Proteus*, the first steamer sent to their relief; the stores left for them proved small in quantity, and the bread mouldy and uneatable. The rations were gradually reduced to the lowest amount possible for sustaining life. Thus they passed through the terrible weeks of darkness, during which one of the party became so terribly frost-bitten as to lose both feet and hands. Then scurvy was added to starvation, and death began to claim its victims. Everything was at last consumed, even articles of clothing made of seal skins, and the party subsisted for some time on shrimps, lichens, seaweed, and saxifrage. On 21st June, 1884, a gale blew down the tent, which they were too weak to re-erect, and with the thermometer at 28° degrees and snowing, they lay down in their sleeping bags waiting for death. But just when hope was utterly dead rescue was at hand, and at midnight on 22nd June the long agony was over, and the remnant of the expedition—consisting only of seven individuals—was saved by the timely arrival of a rescue party from the vessel sent to their relief by the United States Government. Had they reached the spot twelve hours later it is scarcely possible that one of the gallant band would have been found alive. The unwisdom of not leaving a ship with the party in Lady Franklin Bay, and of selecting as a station a spot so uncertain of being reached, was amply proved. "No pen," says Lieutenant Greely, "could ever convey to the world an adequate idea of the abject misery and extreme wretchedness to which we were reduced at Cape Sabine. Insufficiently clothed, for months without drinking water, destitute of warmth, our sleeping bags frozen to the ground, our walls, roof, and floor covered with frost and ice, subsisting on one-fifth of our Arctic ration, almost without clothing, light, heat, or food, yet we were never without courage, faith, and hope. The extraordinary spirit of loyalty, patience, charity, and self-denial—daily and almost universally exhibited by our famished and nearly maddened party—may be read between the lines in the account of our daily life penned under such desperate and untoward circumstances."

SOUTH POLAR EXPEDITIONS.—The expeditions to the South Polar regions have not only been far less full of danger and adventure, but also far less numerous than those to the north. The ancient idea was that there was a great habitable continent at the South Pole, and Cook was despatched for the purpose of settling the question in 1772. Three times the Antarctic seas were traversed; the high latitude of $71^{\circ} 16'$ was on one occasion reached; and the entire extent of the South Pacific and Atlantic Oceans was crossed. No land was seen in the course of a run of 117 days over 8660 leagues. Though the idea of a southern continent, abounding in accessible mineral

wealth, capable of sustaining vegetable life, and providing a new home for the human race, was thus completely disproved, it still remained an open question whether an immense tract of land, or only a frozen ocean, lay between its limits and the south pole. To determine this point, if possible, separate expeditions sailed under the auspices of the French, American, and British governments. But before these national undertakings commenced some interesting results had been attained in the field of south polar adventure, principally by merchant-seamen, pointing to the general conclusion since arrived at. In the year 1818 Captain Smith discovered the New South Shetlands, lying to the south-east of Cape Horn, consisting of twelve large islands and innumerable rocks, all bare of vegetation, but with prodigious numbers of the fur-seal, and the particular species called the sea-elephant, from the enormous size of

the males. In 1821 Bellinghausen, the Russian navigator, found the island of Peter I. in lat. $68^{\circ} 57'$, the most southern land then known. In 1823 Weddell, in a small whaler, discovered the South Orkneys, a group with craggy towering peaks, resembling the mountain-tops of a sunken land; and afterwards penetrated to the latitude of $74^{\circ} 15'$, being the most southerly point then attained by man. South of the Cape of Good Hope, under the Antarctic Circle, Enderby's Land was discovered in 1881 by a whaler in the service of the Messrs. Enderby; and sailing from New Zealand, in 1889, another of their agents met with a volcanic group, to which his own name, the Balleny Islands, was given, and also a coast-line called Sabrina Land, from the name of the accompanying cutter.

The first of the three government expeditions mentioned, the French, consisted of the *Astrolabe* and *Zélée*, under



Christmas Harbour, Kerguelen Island.

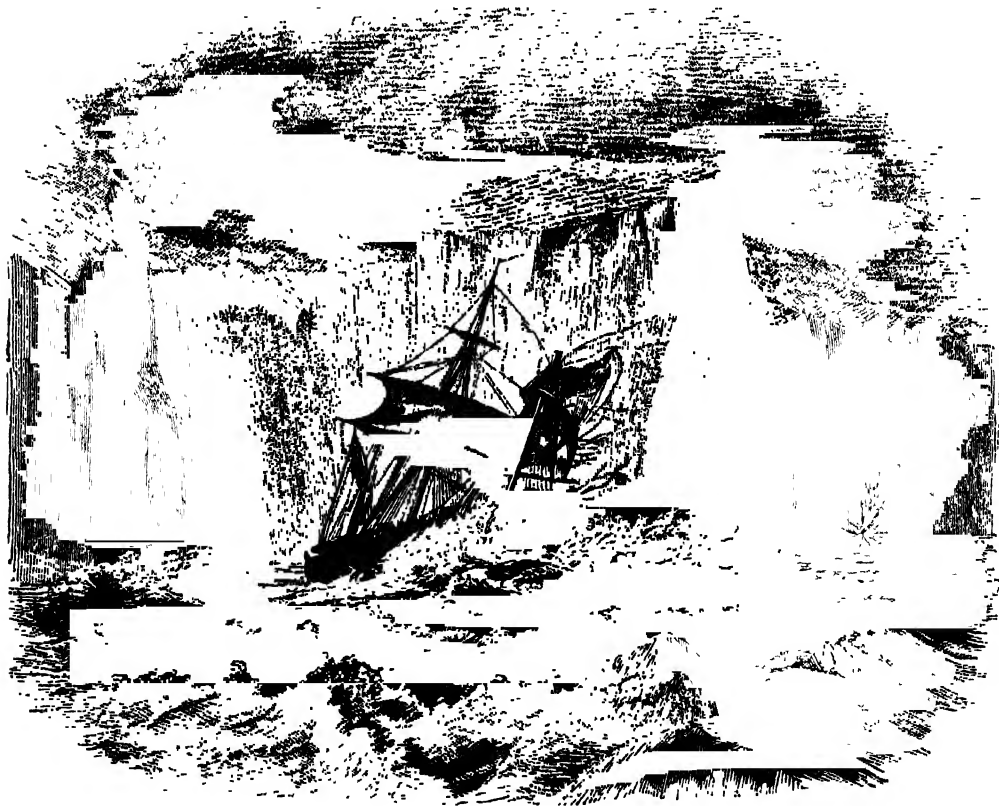
the command of Captain Dumont d'Urville. He sailed from Hobart Town on the 1st of January, 1840, and found land on the nineteenth day, in the seas visited by Balleny, about the latitude of the Antarctic Circle. It was covered with snow, and marked with ravines, inlets, and projections, but had no appearance of vegetation. It was coasted for 150 miles, was very obscurely seen, and named Terre Adèle; but the weak condition of the crews compelled a return to a milder climate. About the same period the American expedition, under Lieutenant (afterwards Admiral) Wilkes, in the frigate *Vincennes*, made its appearance in the same seas, but entered them in a more eastern longitude. He also thought he had found a coast-line, and through a westward sail of four weeks passed over the scene of Balleny's and D'Urville's operations, always having either

land in sight or indications of it. If Balleny's Sabrina Land, D'Urville's Terre Adèle, and Wilkes's coast are continuous, forming the shore of an Antarctic continent, the honour of the discovery belongs to the former. The English expedition consisted of the *Erebus* and *Terror*, under the command of Sir James Clarke Ross—ships of mournful celebrity, afterwards lost, as before stated, in the north polar zone. Its results were more remarkable than any of the preceding, for while the French and American commanders did not reach a higher latitude than 81 degrees the English penetrated to 78 degrees, or within 12 degrees of the south pole, which is likely to remain the limit of human enterprise in that direction. The primary object was to make scientific, and especially magnetic observations in the Southern Ocean, and ascertain the

position of the south magnetic pole. Sir James Ross, already familiar with the icy regions of the north, and distinguished in Arctic adventure by discovering the north magnetic pole, was appropriately appointed to the command. Every suggestion of science and experience was employed in preparing the ships for arduous service, which extended over a period of nearly four years.

The vessels sailed from Margate Roads on the 80th of September, 1839, and reached the Cape of Good Hope on the 17th of March, 1840, long stoppages having been made at Madeira, St. Paul's Rocks, Trinidad, and St. Helena, for the purpose of making the required magnetic observations. While within the tropics the planet Venus was seen near the zenith notwithstanding the brightness of the meridian sun, the sky being very clear; and a high stratum of clouds was observed to be moving in an exactly

opposite direction to that of the surface-breeze, in exact accordance with the theory of the trade-winds. Captain Basil Hall witnessed the same circumstance from the summit of the Peak of Teneriffe; and Count Strelitzki, on ascending the volcano of Kirauca, in Hawaii, reached, at the height of 4000 feet, an elevation above that of the trade-wind, and experienced the influence of an opposite current of air, of a different hygrometric and thermometric condition. Crossing the equator the Magellanic clouds and the Southern Cross marked the further prosecution of a southerly course by their increased altitude in the heavens. On approaching the magnetic equator, or the line of no dip, the gradual assumption by the needles of a perfectly horizontal position was carefully watched, and the signal for being on the exact point of no dip was hoisted from both ships at the same moment. The observation was of



Erebus and Terror in the Pack Ice.

peculiar interest to the commander, who had, a few years previously, seen—what no human eye had seen before—the needle in a directly vertical position at the north magnetic pole; and who indulged the hope, in this expedition, of being permitted to see it again in a similar position at the south magnetic pole of the earth.

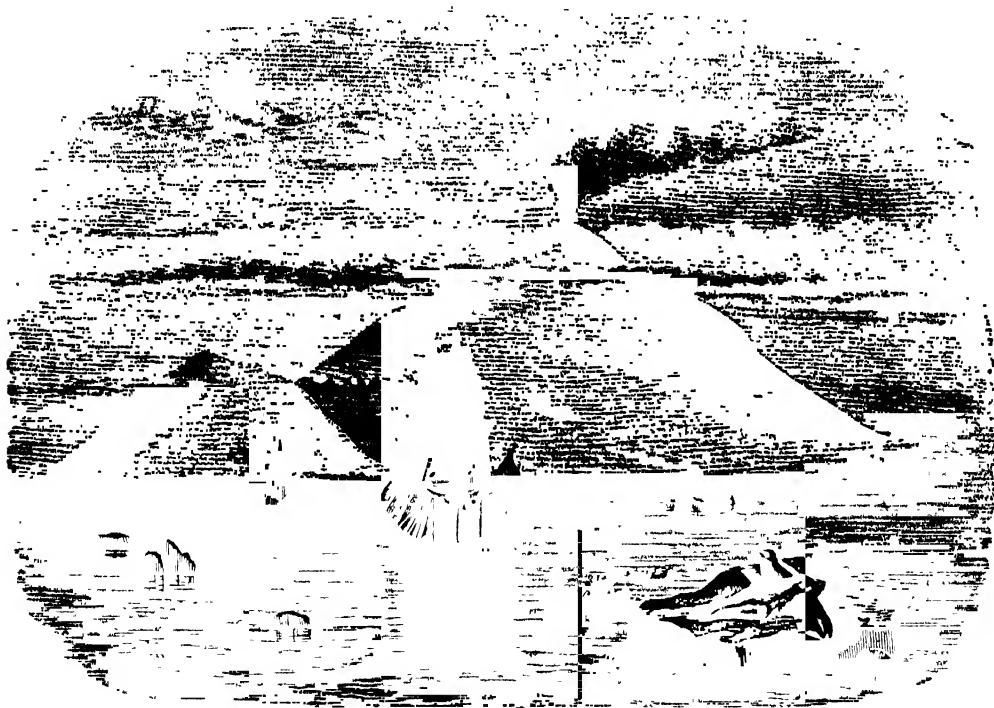
Leaving the Cape on 6th April, the vessels made Kerguelen Island (see cut, p. 96) on 12th May, remarkable for its rigorous climate and vegetable destitution. Though in a comparatively low latitude in the southern hemisphere, corresponding to that of midland Europe in the northern, absolute sterility seemed to reign upon its shores. Not a tree or shrub exists, and only a very few flowering plants were observed. Yet this desolate region was once clothed

with forests destroyed by successive overflows of volcanic matter, whose remains, in fossil wood and seams of coal, are found in abundance imbedded in igneous rocks. No land animals were seen, but the footsteps of a pony or an ass were traced in the snow till lost on reaching a space of rocky ground free from it. The animal had probably been cast ashore from some wrecked vessel. Out of a stay of sixty-eight days it blew a gale of wind during forty-five, and there were only three days free from snow or rain. The gusts were so sudden and violent that the seamen were obliged to throw themselves down to escape their force; and one whose duty it was to register the tide-gauge, was actually driven into the water by a squall and nearly drowned.

On the 16th of August the expedition reached Hobart Town, then under the government of Sir John Franklin, destined in a few years to be mournfully connected with the *Erebus* and *Terror*. They sailed again towards the middle of November, the season of the falling stars, for which the instructions directed a careful lookout to be maintained, but none were seen, only some faint auroral coruscations, a phenomenon neither so common nor so brilliant as in the northern regions. The outward voyage terminated at Campbell Islands, south of the Aucklands, near New Zealand, on 14th December, fourteen months and a half having been occupied by it and the magnetic, tidal, and astronomical observations at the several stations visited. From this island, in lat. $52^{\circ} 33' S.$, and lon. $169^{\circ} 8' E.$, Ross determined to proceed directly southward along the meridian of $170^{\circ} E.$ Christmas Day, although the midsummer-day of the southern hemisphere, and not in a very high latitude, was passed in a strong gale, with constant snow or rain. Soon afterwards the first icebergs were seen, which, unlike those of the Arctic seas, presented

little variety of form, had tabular summits, in some instances amounting to 2 miles in circumference, on all sides bounded by perpendicular cliffs. On the first day of the new year (1841), the ships crossed the Antarctic Circle and came to the edge of the pack-ice. After skirting it for some days in search of a favourable opening it was entered, and the clear sea was lost sight of; from the mast-heads nothing but icy masses being visible around, from which the vessels sustained some violent shocks, and were occasionally in danger. On the fifth day the pack was passed through amid blinding snow and thick fog, which, on clearing away, revealed the cheering view of an open sea; and early in the morning of January the 11th the officer of the watch reported land distinctly seen directly ahead of the ships.

A coast rose in lofty peaks, covered with perpetual snow, but at a great distance. The latitude was about the highest attained by Cook. More land speedily came in sight, consisting of mountainous ranges; and to the principal summits the names of eminent individuals at home were given.



Mount Erebus and Beanfort Island.

Near views of the newly-discovered country are thus described:—"It was a beautifully clear evening; and we had a most enchanting view of the two magnificent ranges of mountains, whose lofty peaks, perfectly covered with eternal snow, rose to elevations varying from 7000 to 10,000 feet above the level of the ocean. The glaciers that filled their intervening valleys, and which descended from near the mountain-summits, projected in many places several miles into the sea, and terminated in lofty perpendicular cliffs. In a few places the rocks broke through their icy covering, by which alone we could be assured that land formed the nucleus of this, to appearance, enormous iceber."

This discovery restored to Great Britain the honour of reaching the southernmost known land, which had previously belonged to Russia. Owing to the ice from the shore pro-

jecting into the sea, and the heavy surf, it was found impossible to perform the ceremony of taking possession upon the mainland. It transpired upon a small adjoining island, entirely composed of igneous rocks, which was called Possession Island. Not the slightest trace of vegetation appeared, but myriads of penguins, which densely covered the whole surface, the ledges of the precipices, and the summits of the hills, unaccustomed to human intrusion, and equal strangers to the fear and power of man, vigorously attacked the landing party with their sharp beaks. This Antarctic region received the name of Victoria Land, in honour of the Queen. It was coasted up to $78^{\circ} S.$ lat.; and near that point a most unexpected feature presented itself. This was a magnificent volcano, rising 12,000 feet above the level of the sea, emitting flame and smoke in splendid profusion, which the explorers called

Mount Erebus, after the leading ship, while a lower extinct crater to the eastward was named Mount Terror.

The approach of the southern winter warned the party to retire to spend it in a lower latitude; and though on two successive seasons the south polar zone was re-entered no results of public interest were obtained, owing to the unfavourable condition of the ice. Victoria Land, thus revealed, perhaps never to be seen again, seems to be entirely of modern volcanic character, while in Arctic regions the great mass of the land consists of primitive rocks and secondary sedimentary formations. Possession Island was found to be composed of volcanic conglomerate, vesicular lava, and basalt. A beautiful little recess in the prismatic columns of basalt presented a miniature picture of Mingal's Cave in Staffa. The main coast showed nothing but jet-black lava or basalt, cropping out in its bold capes and promontories beneath a mantle of eternal frost. Aqueous formations may exist in the interior under its covering of snow, but the contour of the country, seen at a distance, exhibited the true volcanic outline. The Antarctic region, contrary to what is the case in the opposite dark and outer boundary of the earth, appears to have no representative of the vegetable kingdom. The American trembling poplar reaches to the verge of the Arctic Circle; the birch survives to 70° lat. in Europe; shrubs and bushes linger on further north; and mosses and lichens defy the severest cold of the Arctic zone. Man has not yet gone on land beyond the limits of vegetable life in this region; but not the smallest trace of vegetation, so much as a lichen or piece of seaweed growing on the rocks, was perceived in similarly high southern latitudes. The extreme south also differs from the far north in respect of animal life. The latter is inhabited by various tribes, white bears, reindeer, wolves, the polar hare, and Arctic fox, some of which seek no southerly migration to avoid the long rigorous winter. But no terrestrial quadrupeds of any kind appeared on the south polar shores. The oceanic birds—albatrosses, penguins, and petrels—occurred in great numbers, with seals reposing on the ice, and whales spouting in all directions in the open water.

POLARITY (from Gr. *polos*, a pivot, *i.e.* the imaginary pivots especially whereon the axis of the earth turns) signifies, in general, a disposition in a body or in an elementary molecule of a body to place its mathematical axis in some particular direction. Frequently also it denotes in a body the existence, either naturally or induced, of two points possessing contrary properties.

Magnetic Polarity.—If iron filings be strewed over a mass of natural loadstone, it will be found that there are two points on its surface at which the filings are most abundantly attracted, and where they dispose themselves nearly in the direction of a line imagined to be drawn through the mass. [See MAGNETISM.] From an analogy with the axes and poles of the earth, this line is called the axis of the loadstone, and its extremities are called the poles. The like disposition of the filings takes place on a magnetized bar of steel, and the poles or opposite extremities of either material are found to possess a contrariety of character. One extremity always tends towards the northern part of the horizon only, and the other towards the southern part; and if two such prisms or bars are formed and suspended by their centres of gravity, on bringing the northern or southern pole of one near the like pole of the other, they exercise upon each other a mutual repulsion; but if either pole of one be brought near the opposite pole of the other, they mutually attract each other. In order to account for such polarity, it is supposed that the magnetic power in the earth by some means disturbs the equilibrium previously existing among the molecules of magnetic fluid in the natural loadstone or artificial magnet, forcing those which have contrary properties towards the opposite extremities of the mass.

Electric Polarity.—If a cylinder of wood or metal be insulated on a glass stand, and it be then brought near a body which has been electrified by the usual friction or induction machine, it will be rendered polar, that is, one end will possess positive electricity and the other negative electricity, and near the middle the cylinder will be in a neutral state. In an ordinary electric (voltaic) battery, the fluid, by chemical action on the zinc, produces a separation of the two kinds of electricity; that which is called positive is carried to the copper plate, and the latter communicates it to the zinc plate with which it is connected. This action is repeated at every pair of plates in the battery; and the zinc extremity constitutes the positive pole of the battery. At the same time an opposing current of negative electricity passes from the copper, through the fluid, to the zinc, from thence to the next copper plate, and so on to the last; this copper end is called the negative pole of the battery.

Similar division of direction, or compulsory adoption of certain lines, may be impressed upon the forces of light and heat as well as on those of magnetism and electricity. See following article.

POLARIZATION OF LIGHT AND HEAT. Polarization of light is (if we consider light to consist of particles which are transmitted in rectilinear directions from a luminous body) the effect of an attraction exercised by the particles of what are called double refracting crystals, or of certain reflecting surfaces, upon the particles of light when these pass through the former, or are incident upon the latter at a particular angle. By those attractions the particles, considered as not perfectly spherical, are supposed to suffer such changes of disposition, that their axes, or their homologous faces, become parallel to one another, or are directed towards the same part of space. But if we adopt the undulatory hypothesis, now practically the only one held, a different explanation must be given. In this case (understanding that the vibrations of the ethereal medium, in causing the perception of common light, take place in any direction in planes at right angles to the direction in which the ray is moving), when a ray is polarized in the ordinary manner the vibrations still take place in planes perpendicular to the direction of the ray, but in lines parallel to one another. A plane passing through the direction of the ray and perpendicular to all the lines of vibration, is called the plane of polarization. A polarized ray of light is incapable of reflection at the surface of glass, or other transparent media, at certain angles and in certain positions of the plane of incidence. The subject is fully considered and illustrated in the article LIGHT.

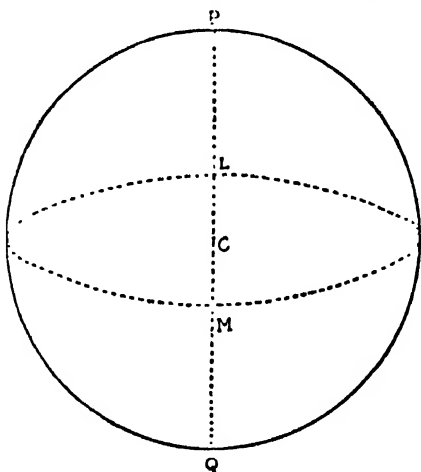
POLDER, a Netherland name given to cultivable land, obtained from drained lakes or marshes, and lying below the level of the sea.

POLE. See PERCH.

POLE. Imagine a sphere to be cut by a plane passing through its centre, then the intersection of the sphere and the plane forms a great circle, and the two points on the sphere which are 90 degrees from the great circle are said to be its *poles*. Thus, if *O* be the centre of the sphere (see cut, next page), and if *A I. B M* be its section by a plane through *C*, then the line *R Q*, perpendicular to the plane of section, and passing through *C*, intersects the surface of the sphere in the two points *P* and *Q*, which are the poles of the great circle. If the sphere represent the earth, and if the section *A M B L* be the plane of the equator, then the points *P* and *Q* are the north and south poles of the earth respectively.

The word pole has a special significance on the celestial sphere. The plane of the earth's equator extended to the celestial sphere intersects that sphere in a great circle, the two poles of which are points of the greatest importance in astronomy. The poles may be otherwise defined to be the points in which the axis of the earth, when

produced, intersects the celestial sphere. The pole in the northern hemisphere happens to be situated at present near a bright star, the **POLE-STAR**, and around the pole the whole fabric of the heavens appears to revolve in one sidereal day. The word pole is, however, sometimes used with respect to other great circles than the equator. Thus



the zenith is the pole of the horizon, while the pole of the ecliptic is a point of considerable importance in many inquiries.

Magnetic Poles of the Earth.—These are by no means coincident with the poles of the earth's axis; and consequently the needle of the compass which points magnetic north, does not indicate the true north. The deviation is called the **DECLINATION**, and it varies year by year, since the magnetic poles are not constant. In 1880 it was $18^{\circ} 40'$, but by 1886 it had decreased to $17^{\circ} 40'$, and was still decreasing. The magnetic and the north pole coincided in the year 1622, and were widest apart in the year 1816, when the magnetic pole was $24^{\circ} 30' W.$ of the north pole. The two will coincide again about the year 1976.

Poles of Cold.—This expression, due to Sir David Brewster, though occasionally used, is not now in favour. It is merely necessary to explain that he considered there were three poles of cold in the earth, two in the northern and one in the southern hemisphere. The subject is treated fully in the article **ISOTHERMAL LINES**, and the Plate illustrating it.

POLE, REGINALD, generally known as **CARDINAL POLE**, was the son of Sir Richard Pole and Margaret, countess of Salisbury, and was born at Stourton Castle, Staffordshire, 3rd March, 1500. Designed from his childhood for the church, he was educated first in the Carthusian monastery at Sheen, and afterwards at Magdalen College, Oxford. About 1520 he went abroad to pursue his studies at Padua, where he remained five years. Pole accepted in 1530 a mission to the Sorbonne to obtain a decision upon the question of the divorce of Henry VIII. He refused, however, to give his approval to the king's design, and when the latter, in order to obtain his support, offered him the Archbishopric of York, Pole declined the offer, and retired to the Continent. In 1535 he published an attack upon the conduct of the king in connection with the divorce and his treatment of the church, under the title of "*Pro Unitate Ecclesie*." This led to the withdrawal of his pension and preferments, and to the arrest and subsequent trial and execution of his mother, the Countess of Salisbury, and his relatives, the Marquis of Exeter and Lord Montague. In 1536 he was made Cardinal, and during the ten years

which followed, he was employed by the papal authorities on several missions to the sovereigns of Europe for the purpose of procuring the invasion of England and the overthrow of Henry VIII. In 1545 he went to the Council of Trent as one of the representatives of the Pope, and presided at some of its preliminary meetings. In 1549, on the death of Paul III., he was a candidate for the papal chair, and all but succeeded in obtaining election. After his failure he retired for a time to a monastery near Verona, but was recalled to public life by the death of Edward VI. and the accession of Mary. In 1554 he returned to England as papal legate, and in this capacity he received the national submission, and accepted the terms proposed by the Parliament. He was appointed Archbishop of Canterbury after the execution of Cranmer, and was also made chancellor of the Universities of Oxford and Cambridge. After the death of Gardiner in 1555 he became Mary's chief adviser, and though, upon the whole, he was in favour of a moderate policy, he cannot be cleared from a participation in the cruel persecutions which disgraced the reign of that queen. In 1557 he fell into disfavour with the dominant party at Rome, and Pope Paul IV., a personal enemy, not only cancelled his powers as legate, but also summoned him to Rome to answer a charge of heresy. Pole, however, was too well acquainted with the papal court to obey the summons, and made the most earnest efforts to obtain a retraction of the sentence. In this he was unsuccessful, and the negotiations were cut short by his death, 18th November, 1558, a few hours after the death of Mary. The character of Pole has been vigorously and severely portrayed by Froude in his "*History of England*." Besides the treatise "*Pro Unitate Ecclesie*," already mentioned, he is also the author of a book "*De Concilio*," and of other treatises on the authority of the Roman pontiff and the Reformation of England, and of very many important letters, full of interest for the history of the time.

POLE-AXE, a kind of battle-axe having a long handle, which was a favourite weapon for infantry during the mediæval period. There were many varieties of this arm, and some of them combined with the axe a spear point and a spike or hammer. Perhaps the most celebrated variety of the pole-axe was the Lochaber axe, which was used with terrible effect in many engagements by the Scottish Highlanders. Long handled pole-axes were also used with much success by the Hussites, and on more than one occasion the peasant followers of John Ziska, armed chiefly with these weapons, gained important victories over the armed knights and trained mercenaries of the German Empire. In modern times the name pole-axe is given to the broad-bladed axes used in the navy by and against boarders, and also to the heavy spiked axes used by knackers and butchers for slaughtering horses and horned cattle. The former has a handle about 15 inches long, and a sharp point bending downwards at the back opposite the blade.

POLECAT (*Putorius fetidus*) is a well-known animal belonging to the family *MUSTELINÆ*, which contains the weasels and martens. The polecat is a larger and stouter-built animal than the marten. It measures about 2 feet in length, including the tail, which measures about 6 inches. The fur is of a dark brown tint, with white markings on the face. There are two kinds of hair, the shorter woolly and yellowish in colour, and the longer brownish-black. The fur is coarse and of little value, but is sold under the name fitch. The disagreeable odour so characteristic of this species is produced by a fatty substance secreted by a pair of glands situated near the root of the tail. To this it owes its name of *foumart* or *foulemart*, said to be a contraction of "*foul marten*," and possibly its other English name of *fitchet*. The polecat is found throughout the whole of Europe, except the extreme north and south. It is one of the most destructive of the

Mustelidæ, its appetite for slaughter being quite insatiable. Its ravages among hares, rabbits, and game birds are notorious, and the poultry yard also suffers severely from its depredations, for it not only kills fowl, ducks, geese, and turkeys, but is also very fond of eggs. Snakes and lizards, frogs, fish, and in fact any vertebrate that it can catch and kill, fall victims to this bloodthirsty animal. Its lair is made in a rabbit burrow, or in some similar snug retreat, among stones and rocks covered over with long grass, tangled herbage, or low brushwood. In the winter it often takes up its quarters in barns or out-houses. It sleeps during the day, sallying forth at night on its career of destruction, and bringing home part of its victims for food. The female produces towards the end of spring, or in early summer, a litter of from three to

turns in space. If the axis were prolonged into space beyond the North Pole it would very nearly touch, though not quite, a certain star, Alpha of Ursa Minor (the star called Cynosura—*Kynosoura*—dog's tail, by the Greeks); this star, therefore, seems to be stationary in the heavens, and all the sky wheels round it as upon a pivot; we call it the Pole-star, and speak and think of it as the North Pole. When we dwellers in the northern hemisphere look at it, we look to the north. There is no star at all suitable as a South Pole-star. But the Pole-star is not truly north, if we are to be exact. It is found upon very close observation to perform a small circle round the true heavenly north pole; so small that most unskilled observers are not conscious of it. It will be much nearer north in about 300 years' time than it is now.

Alpha Ursæ Minoris is a very good Pole-star for us at present, but there was a time when another star was nearer the pole, and there will come a time when yet a third star will be the Pole-star of the future. In 12,000 years Vega (Alpha Lyre) will have that honour. The cause of this variation is that peculiarity in the motion of the earth called PRECESSION, from the precession of the equinoxes which is its chief result. It is elsewhere described, but may here be shortly said to be a kind of reeling motion of the earth's axis, such that its poles describe a circle whose arc diameter is about 47 degrees round the poles of the ecliptic, that is, just double the inclination of the earth's axis ($23\frac{1}{2}$ degrees). The accompanying



The Polecat (*Putorius feticulus*).

eight young. The polecat is a very ferocious animal, inflicting severe wounds on its would-be captor, and is very tenacious of life.

The FURBER is a domesticated variety of the polecat, with which it breeds freely. It is a little smaller, and is a good example of an albino, its fur being yellowish-white and its eyes pink.

A polecat, *Putorius nigripes*, nearly allied to the European species, is found in the United States, extending southwards as far as Texas. It lives in the burrows of the prairie-dogs (*Cynomys*), and preys upon them. *Putorius evermanni*, another similar species, but with head and back white, is found in Siberia. The Mottled Polecat (*Putorius sarmaticus*) is a small and rare species, extending from Southern Russia to Afghanistan. It is remarkable for having its head and back white, mottled with large irregular reddish spots.

POLEMONIACEÆ is an order of plants belonging to the group COROLLIFLORÆ. They are herbs with opposite or alternate leaves, and flowers in clusters. The calyx is five-fid, persistent; the corolla is regular, hypogynous, with the limb five-lobed, the lobes being convolute in æstivation; the stamens are five, free, alternate with the lobes of the corolla; the ovary is three-celled, with the style three-lobed at the top. The fruit is a three-celled, three-valved capsulo. The species are not very numerous, inhabiting temperate regions chiefly, and especially North America. One species, *Polemonium caruleum*, the Greek Valerian or Jacob's Ladder, grows in the north of England in bushy hilly places, but is somewhat rare; it is very common in cottage gardens. It has bright blue or white rotate flowers in terminal corymbs. Species of the North American genus PHLOX and other genera have been introduced into this country as ornamental plants.

POLE-STAR (Gr. *polos*, a pivot). The North and South Poles are the imaginary pivots upon which the earth's axis

turns. It is sufficiently accurate for ordinary purposes, but to be quite accurate the small wavy motion with a period of eighteen and a half years, called NUTATION, would have to be shown, and for clearness' sake this has been omitted. A more important correction, if it were possible to show it, would be due to the gradual change of position of the pole of the earth's ecliptic, due to the action of gravitation by the other planets of the system; a movement whose amount (a circle, of diameter $3^{\circ} 11'$) is known, but not its period. Owing to this fact, one of those at present exciting the astronomic world, it is believed that in the last 3000 years the pole of the ecliptic has neared the pole of the equator (which means that the inclination of the earth's axis has lessened) by 25 minutes. However, these corrections, though very important to astronomers, would alter scarcely perceptibly the circle shown on the Plate. Referring to this we see that Thuban (α Draconis) was an excellent Pole-star in B.C. 2700. It was the Pole-star of the Pyramids, and as the construction of the slanting passage in the great pyramid (if meant for observation of the pole) would postulate an angle of $8^{\circ} 40'$ for the star under observation as reckoned from the true place of the pole, this fixes the date of the great pyramid as either 3350 or 2170 B.C., at both of which times α Draconis or Thuban was at that distance ($8^{\circ} 40'$) from the true north pole of the heavens. The second date being manifestly too recent, the first is fixed. Another result of Thuban's being the Pole-star, is to arrange the constellations much for the better. If we take a celestial globe and put the finger on Thuban, rotating the globe with that as a pole, the Dragon soars aloft, the Centaur and the Altar are once more upright, the smoke of stars ascends vertically from the altar, and Argo sails on an even keel. Precession has distorted

all the figures, and it is only thus that we can restore them to the shapes and movements which caused our Chaldean forerunners to give them names so many centuries ago.

POLIAN'THES. See TUBEROSE.

POLICE is that department of administration which has for its aim the safety and peace of the community. Its primary object is the prevention of crime and the pursuit of offenders; but the police system also serves other purposes, which, though not strictly involved in the popular definition of crime, are yet of great importance to the public well-being. In the early periods of British history the national police arrangements were based upon the theory that every member of the community was bound to sustain the law by action when required, and might be called upon by the magistrates at any time to render aid in protecting life and property. Later it became usual for the towns and parishes to appoint paid officers to act as constables, watchmen, or police officers, and many places were empowered by local Acts of Parliament to impose rates and taxes for the maintenance of such officials. In the course of time the growth of the population and the increased facilities for travelling that were introduced, rendered the old arrangements inadequate to the requirements of the country, but instead of the constabulary force being reorganized and adapted to a new state of society, its powers were weakened, and it was left thus to cope with circumstances which demanded increased vigilance, activity, and intelligence. During the latter part of the past century and the commencement of the present, the want of confidence in the old police force was attested by the existence of numerous voluntary associations for the apprehension and prosecution of felons, whose funds were expended in the prosecution of criminals, and not in the prevention of crime. Some of these associations had rules which bound the members, in cases of highway robbery, horse stealing, &c., to take horse and join in pursuit of the thief.

To correct the various evils incident to the constitution of the old rural constabulary, the magistrates of Cheshire, in 1829, made the first provincial attempt to improve the administration of police in their county, and they obtained an Act (10 Geo. IV. c. 97) which authorized them to appoint and direct a paid constabulary. During 1828, however, a committee of the House of Commons, appointed at the instance of the then home secretary, Mr. (afterwards Sir Robert) Peel, had reported that it had become absolutely necessary to thoroughly reorganize the police arrangements of the metropolis, and in 1829 the celebrated Act for improving the police in and near London was passed (10 Geo. IV. c. 44). This Act provided for the establishment of a sufficient number of able men, to whom were intrusted the common-law powers, privileges, and duties of constables, and placed the control of the whole body in the hands of a commissioner, who was immediately responsible to the home secretary of state. The district included in the Act extended over the whole of the metropolis, excluding the city, and for 12 miles round, and this was formed into divisions and sections for its better administration on the same general system as at present exists. The new force was by no means well received by the public, and the first constables had to endure considerable persecution on the part of the rabble, though the latter soon found that the officers were more formidable opponents than their predecessors the watchmen. The name of the statesman who had introduced the measure, and who was then under a cloud of unpopularity, was transferred to the police, and the terms "Bobby" and "Peeler," then introduced, have been perpetuated to the present day. In a few years, however, the feeling of hostility died away, and the efficiency of the new force having been proved, an Act was passed in 1839 (2 & 3 Vict. c. 47) by which the

metropolitan police district was extended to 15 miles from Charing Cross, the whole of the river Thames was brought within it, and the powers of the metropolitan police were extended to the royal palaces and 10 miles round them. The city of London, which had been exempted from the operations of these statutes, was, by the 2 & 3 Vict. c. 94, provided with a similar force under a special commissioner entirely under the control of the city authorities. Other cities and boroughs subsequently acquired, by private Acts of Parliament, the necessary powers to enable them to institute and maintain police on the model of the metropolitan force.

Until 1856, however, the Acts relating to the county constabulary left the initiative to the discretion of the magistrates, and, as a consequence, very many English and Welsh counties continued to be without protection, save such as was afforded by the parish constables; but the 19 & 20 Vict. c. 69 made it compulsory on the magistrates of every county, where no police had hitherto been constituted, to establish the force at once. By the same statute, provision was made for imposing one-fourth of the expense of the force, whenever it was efficient, on the Consolidated Fund, the remaining three-fourths being charged upon the county rate. This ratio was maintained until 1874, when the government increased to one-half the grant from the Consolidated Fund towards the expense of the county police. In 1856 the management of the metropolitan police force was intrusted to one commissioner and two assistant commissioners in the place of the two commissioners originally appointed, and to these a third assistant commissioner was added in 1884. In 1866 the jurisdiction of the metropolitan police was extended to the royal naval dockyards and principal military stations of the war department in England and Wales, with the restriction that the powers and privileges of the constables of the metropolitan police, when without the yards, naval and marine hospitals and infirmaries, and marine barracks and stations, and not on board or in any ship, vessel, or boat belonging to the queen, or in her service, shall only be used in respect of the property of the crown or of persons subject to naval or marine or military discipline.

Thus, by a series of steps, beginning with the Act of Sir Robert Peel in 1829, England was at length placed under the protection of a well-devised and very efficient system of police, whose surveillance of the country is now continued throughout the whole of the twenty-four hours. The members of the force are not allowed to exercise any other employment.

It is impossible to enumerate within the limits of this article the whole of the multifarious duties which now devolve upon the police force of this country, but the following summary may serve to give some idea of their extent and importance. First, in reference to crime, it is the duty of the police to use their utmost endeavour to prevent all robberies, burglaries, felonies, and misdemeanours, with all other outrages, disorders, and breaches of the peace, and to apprehend and secure all felons, rogues, vagabonds, and disorderly persons who shall disturb the public peace, or any party or persons wandering, secreting, or misbehaving himself, herself, or themselves, or whom they shall have reasonable cause to suspect of any evil design; and to secure and keep in safe custody any such person, in order that he or she may be conveyed as soon as convenient before a magistrate or justice of the peace to be dealt with according to law. The special powers and privileges bestowed upon the members of the police force to enable them to perform these duties have been noticed under **CONSTABLE**. For the better prevention of crime and the detection of offenders, a limited number of the police perform their duties out of uniform, and are termed detectives, their branch of the service being known as the criminal investigation department. The constables

and sergeants of this department are selected from the general body of the force, the higher officers being appointed for their aptitude, knowledge of foreign languages, &c. The police make most of the arrangements for the prosecution of ordinary criminals, and they have charge of all prisoners during the time covered by the proceedings preliminary to the imposition of sentence or committal for trial. They have also the oversight of persons who have been sentenced to penal servitude, but who have been released on ticket of leave, and of all convicts who have been sentenced to remain after their imprisonment under police supervision for a time. The police also are in general the instruments for carrying out the statutory provisions respecting certified industrial schools and reformatories. Among numerous other miscellaneous duties the police act as coroner's officers; make inquiries as to suicides and accidents of all kinds; and deal with destitute persons, and persons seized with sudden illness in the streets. In the metropolitan police district the licensing of public carriages, which is vested in the secretary of state, is administered by the commissioner of police, and the police also adjust the street traffic, prevent obstruction, guard the footpaths from riding and driving, and prevent persons from riding or driving furiously to the danger of the public. All public houses and places licensed for the sale of intoxicating liquors are under the charge of the police, and they visit and inspect most of the places opened for public amusement. The laws and regulations for common lodging houses in the metropolitan district (about 1100 in number, accommodating over 30,000 lodgers), are under the police, all such houses being registered and open at all times to inspection. Property left or lost in public carriages is also placed under the care of the police, who are thus intrusted with the care of over 20,000 articles yearly, about half of which are afterwards claimed by the owners, the remainder being restored to the finders or sold as unclaimed. The police also give warning to the firemen in cases of fire, and assist in keeping order; prevent the fraudulent removal of goods; deal with the care and keeping of explosive substances; furnish the pawnbrokers with lists of stolen articles; take charge of stray animals, ownerless dogs, &c.

The total number of the police force in 1886 was 30,000, being at the rate of one to about every 770 of the population. The borough constables are in the proportion of one for every 750 of the population, the county constabulary one for every 1230, and the metropolitan police one for every 412. The annual cost is between £3,500,000 and £3,500,000, or a little over £97 10s. per man.

The city of London police—a very superior body of men—number about 900, and cost over £90,000 per annum. No contribution is made from the public revenue with regard to them. The proportion of the police in the city of London is one for about every 57 of the resident population as enumerated on the night of the census of 1881. In connection with the latter item it must be remembered that while the night population of the city only numbered 50,526, the population actually resident or employed during the day numbered 261,061 persons, while close upon 800,000 persons entered the city precincts during the twenty-four hours.

Details of the Irish police—one of the best forces of the kind in the world—will be found in the article IRELAND.

In Scotland a system of police has been established in the more considerable towns by special acts, as, for instance, the 42 & 43 Vict. c. 32 (the Edinburgh Act). The object of these special Acts is to provide for the watching, lighting, and cleaning of the streets, and the punishing and suppressing of minor offences. These Acts are worked by boards of elected commissioners. The Act 25 & 26 Vict. c. 101 (1862), Provost Lindsay's Act, is a General Police Act, the provisions of which, or a portion of them, may be adopted, so as to become law, by any royal

burgh, burgh of regality, or burgh of barony, or populous place, at a meeting of a specified number of £10 householders. The Act provides for the election of commissioners with power of management and control by the same class of persons who are entitled to decide on the adoption of the Act. By 20 & 21 Vict. c. 72 (1857), called the Rural Police Act, the commissioners of supply of any county are authorized to assess the county for maintaining a constabulary force. The Act directs the commissioners to publish annual accounts of receipts and expenditure. The number of police in Scotland in 1886 was 3800.

In the army a number of steady intelligent soldiers are placed under the provost-marshal to act as military police. They have charge of the army sanitary arrangements, arrest all persons out of bounds, disorderly soldiers, and generally all who infringe discipline.

POLICY, as used in commerce, is an Anglicized form of the Italian *polizza*, a promise; and means some kind of promise to pay. The Lombard bankers of the middle ages introduced the term and the business principle, applying it specially to marine insurance. For a certain *premium* (Lat., price) they issued a policy promising to pay a much larger sum than the premium in the case of a certain somewhat improbable event. The similar promises in fire and life insurances are also called policies.

The form of marine insurance policy now used is precisely the same as that adopted at Lloyd's on 12th January, 1789, except that "In the name of God, Amen," has given place to "Be it known that."

A policy differs from many contracts, in being signed by one party (the insurer) alone, whence he is often called the *underwriter*. A policy of insurance is thus an example of a "unilateral contract." See INSURANCE.

POLITIAN. See **POLIZIANO**.

POLITICAL ECONOMY. In ordinary language the term *economy* usually means frugality, and sometimes, but more rarely (in such phrases as—the economy of the universe) it is used to convey the idea of a well-ordered and harmonious whole. The word is taken from the Greek *oikonomia* (made up of *oikos*, house, household, and *nomos*, arrangement, rule, established law), and meant originally the management and arrangement of domestic affairs, and distribution of household expenses. By the addition of the adjective *political* (from the Greek *politikos*, pertaining to state affairs) *economy* comes to mean the management of the State, more especially in relation to its wealth. Until the publication of Adam Smith's great work in this country, and the teachings of the Physiocrats, in France, about the same time, this was the recognized object of the study. It was considered to be one of the functions of monarchs and statesmen to arrange the industry of the country, somewhat as the head of a family arranges the industry of his household. Indeed, this is expressly laid down by Sir James Steuart in his "Inquiry into the Principles of Political Economy," which appeared in 1767, only nine years before Adam Smith's "Wealth of Nations." Sir J. Steuart says in his introduction—"What economy is in a family, political economy is in a state. . . . The great art of political economy is first to adapt the different operations of it to the spirit, manners, habits, and customs of the people, and afterwards to model these circumstances so as to be able to introduce a set of new and more useful institutions."

Adam Smith and his French contemporaries maintained, on the contrary, that all state interference with production and exchange is mischievous, and advocated what they called natural liberty—"the sovereign," to use Adam Smith's own words, "being completely discharged from a duty, in the attempting to perform which he must always be exposed to innumerable delusions, and for the proper performance of which no human wisdom or knowledge could ever be sufficient."

Political economy having ceased to be regarded as merely

a branch of the art of government, took rank as an independent study concerned with the investigation of the nature of wealth and the laws of its production and distribution. In England especially, owing to the influence of RICARDO, it has gradually been divided into two clearly defined branches—the abstract science, which studies the social phenomena to which wealth gives rise in order to discover the general laws by which they are governed; and the art of political economy, which seeks to deduce from these laws, with the modifications required to suit the peculiar circumstances of different communities, certain guiding principles for the wise administration of public and private wealth. As the principal subjects of political economy are described separately [see BALANCE OF TRADE, INTEREST, PRICE, PROFIT, RENT, VALUE, WAGES, &c.], the present article will consist chiefly of a sketch of the history and development of the science in Europe up to the present time.

Although political economy, considered as an independent science, is of such comparatively recent origin, its germs can be traced far back in history. Aristotle, in his "Ethics" and "Politics," may be said to have summed up all the economic knowledge of the ancient world, and when in the middle ages we come upon traces of economic literature, we find his views reproduced and quoted. The clergy, in those days the principal repositories of whatever learning there was, naturally took the lead in economic study. Their attention was mainly directed to the vexed question of interest or usury, for there seems to have been no clear distinction between these terms. St. Thomas Aquinas (1226-74), the greatest theologian as well as the only remarkable economic writer of his age, reproduces Aristotle's definition of the function of money as the medium of exchange, and founds on it a bold condemnation of the depreciation of the standard—a common device of princes then as well as in much later times. St. Thomas also supports the severe canon and civil law against usury, by quoting Aristotle's saying that it is unnatural that money should produce money, and by the authority of several passages of scripture. These, with other more general economic questions, also engaged the attention of schoolmen in the fourteenth and fifteenth centuries, the principal writers being Jean Buridan, who was governor of the University of Paris in 1327, Nicholas Oresme, bishop of Lisieux (died 1382) in the fourteenth century, St. Bernardin of Siena (1380-1444), and St. Antoine, archbishop of Florence (1389-1455), as well as numerous political writers in Italy, who turned their attention incidentally to economic questions, in the fifteenth century. The great development to which manufactures and commerce had attained under the Italian republics, and the literary culture encouraged by such rulers as the Medici of Florence, will account for the large amount of attention given to economic subjects in Italy in comparison with less advanced countries.

We have now come to the time when those great events—the discovery of America, the Reformation, and the discovery of printing—produced a revolution in institutions, opinions, and theories, which could not be without its effect on economic literature. The growth of commercial enterprise, and the constantly increasing importance of production for trade in comparison with that for immediate consumption, gave rise to numerous credit institutions, such as bills of exchange, insurances, and mortgages, and gradually produced a modification of the canonical and civil prohibition of interest. It was not, however, until 1766 that the doctors of the Sorbonne admitted that the creditor might claim compensation on the ground of loss or cessation of gain, the risk of partnership, and the cost of the transport of money; and the Catholic church still formally condemns interest, though by a bull of 1830 confessors were allowed to neglect the question. Protestant theologians have, as a rule, admitted the legitimacy of interest.

In Italy the *monti-di-pieta*, or pawnbrokers' shops, which had spread there during the second half of the fifteenth century, at first lent money gratuitously on security, but afterwards charged interest, and became the subject of a fierce controversy between the Dominicans, who took the old ground as to the unlawfulness of interest, and the Franciscans, who defended the *monti* as being a refuge for the poor from the heavy usuries of private money-lenders—chiefly Jews.

From an economic point of view, the most important event of the sixteenth century was the introduction of what is known as the mercantile or restrictive system.* The discovery of America, and the sudden addition to the supply of the precious metals in Europe, with the rise of prices which followed, directed attention more and more to questions of money and of foreign trade, in all times considered the most abundant source of wealth. The popular notion that wealth consisted in money, or in gold and silver, and that the readiest way to enrich a country was to heap up gold and silver there, seemed to be confirmed by the extent to which commercial and political power was concentrated in the hands of those nations which, standing first in the manufacturing and commercial arts, set in motion a comparatively large quantity of money, either drawn from their own mines, as in the case of Spain and Portugal, or attracted by their trade, as in Italy, Flanders, Holland, and, later, in England. It was further supposed that a country which had no mines of the precious metals, could only obtain them by the balance of trade, or by exporting to a greater value than it imported, the balance in its favour being, it was assumed, necessarily paid in money. These two ideas formed the basis of the mercantile system, whose two great engines for enriching a country were restraints upon importation and encouragements to exportation, except in the case of gold and silver, the exportation of which was at first strictly prohibited.

This system was first put into operation by Charles V. of Spain (1516-55), who took very severe measures against the exportation of money, and favoured the introduction of prohibitions and monopolies. Restrictions upon imports were advocated by an eminent French politician, Jean Bodin, in his work "De la République" (1576), and his example was followed by an anonymous English writer, "W. S." (probably Wm. Stafford), in a dialogue called "A Compendious or Brief Examination of Certain Ordinary Complaints," &c. (London, 1581).

Sounder ideas were, however, not entirely without advocates. The well-known essayist Montaigne pointed out the advantages of unrestricted trade in a letter to the King of Navarre in 1583, and the famous Sully (minister of Henry IV. from 1589 to 1610), in a passage quoted by M. Garnier, a living French economist, speaks of the diversities of soil, climate, and natural products in the world as intended by Providence to stimulate international trade, and so knit human society together. The subject of the colonies and their relations with the mother country engaged the attention of an important group of English writers, with Sir Walter Raleigh at their head ("Essay on Trade," 1595). Disregarding the question of the importation of gold and silver, which was the ruling motive in the colonial system of Spain and Portugal, they aimed at promoting the national industry as much as possible, by confining trade with our colonies to English manufactures carried in English ships.

In contrast with the political writers who expounded theories relating to the government of states as they actually existed, the ferment of men's minds in the sixteenth century caused by the sudden enlargement of their conceptions of the world, produced a number of interesting works whose authors, spurning the narrow limits of the actual as found in the states existing around them, delight in describing ideal communities supposed to have been

discovered in hitherto unknown parts of the world. First and foremost among these, both in order of time and of merit, comes Sir Thomas More's famous "Utopia" (first printed at Louvain in 1516), recommended by Erasmus as showing the true source of all political evils. Then there was the strange Florentine writer, Antonio Francesco Doni, with his "Mondi, celesti, terrestri ed infernali" (1552-53). Bacon's "New Atlantis" and the Dominican Tommaso Campanella's "Civitas Solis" were probably written towards the end of the century, and both made science the civilizer which binds man to man and leads him to the love of God. We have no space to dwell on the details of these schemes, but it is interesting to observe in passing that the institution of private property, which modern socialists denounce as the root of all our social evils, found no more favour with the constructors of these ideal communities. It is worthy of note also that bi-metallicism was not without its advocates in the sixteenth century, and two Italian writers, Davanzati and Gasparo Scaruffi, towards the end of the century, both proposed the adoption of a uniform monetary system, with a double standard based on the proportion of value (then 12 to 1) between silver and gold.

The mercantilist theories, which had gradually gained ground in the sixteenth century, and been set forth by Bodin in France and "W. S." in England, received further development in the seventeenth century, and were formulated with increasing fulness and precision. The mercantilists of the seventeenth century, however, did not approve of the foolish and violent measures against the exportation of money resorted to by Spain and Portugal, and which seem about that period to have made part of the policy of most other European nations, including England and France. As countries became more and more commercial, the merchants found such restrictions extremely inconvenient and injurious to their trade, and loudly protested against them. Thomas Mun, a London merchant, and the foremost English mercantilist of his time, forcibly showed the shortsightedness of such a policy in his book, "England's Treasure by Foreign Trade, or the Balance of our Foreign Trade is the Rule of our Treasure" (published in 1664, after his death). The opposition of the merchants triumphed. The prohibitions on the export of gold and silver were in England and France limited to the coin of the respective countries, while in Holland and some other countries even this restriction was abolished. The attention of governments was diverted from efforts to prevent the exportation of gold and silver to the even more difficult task of preventing an excess of imported over exported goods, the only cause, as they were now brought to believe, which could occasion any serious diminution in a country's stock of those metals. The title of Mun's book became a fundamental maxim in the political economy of all commercial countries, and the internal or home trade was considered to be of quite secondary importance, as it neither brought money into the country nor carried any out of it.

While the mercantilists all agreed in advocating high duties on foreign manufactures, the more subtle of them wished to encourage the importation of foreign raw materials for manufacture, and also to allow the free importation of necessities, so as to make labour cheaper, and thus reduce the cost of production in comparison with foreign competitors.

As the balance-of-trade system became more firmly established, the extraordinary importance attached to foreign trade led to the bounties on exports, which in the eighteenth century were very numerous, and were granted both on the products of manufactures and of agriculture. They still survive in the sugar-bounties of France and Germany, from which consumers in this country gain so much benefit at the expense of those nations.

One of the first important steps in restrictive legislation

by this country was the Navigation Act, passed by the Long Parliament under Cromwell, which endeavoured to give the sailors and shipping of England the monopoly of our trade, in some cases by the absolute exclusion of, and in others by heavy burdens upon, the shipping of foreign countries.

The French minister Colbert brought into force the first systematic application on a large scale of the mercantilist theories, and by the tariff of 1667, mainly directed against the Dutch, imposed very high duties upon a great number of foreign manufactures. It was about the same time that the French and English began to oppress each other's industry by duties and prohibitions, but not without some protest, at least in this country. A remarkable pamphlet, entitled "England's Great Happiness, or a Dialogue between Content and Complaint," contends that if there be a demand for wine, fruit, &c., their importation in exchange for money is advantageous; and on this ground defends the French trade, which was loudly condemned by the so-called practical men. In 1678 the importation of French goods was practically stopped for three years, and trade between the two countries was afterwards only carried on under very great restrictions until the famous Treaty of Commerce, negotiated by Cobden on one side and Chevalier on the other, in 1860.

The economists of the seventeenth century may most conveniently be classified according to their attitude towards the commercial system. More enlightened views were advocated by certain writers in various countries, especially in England, who professed more or less widely the theories of free trade. Sir Dudley North, in his "Discourses upon Trade, Interest, Coinage," &c., published in 1691, defends freedom of trade from a cosmopolitan, and not from a merely national point of view, and asserts that as regards trade the world consists of only a single nation. He also points out with great force the proper function of money, and the mistake of imposing duties on its exportation. In this, however, he had been anticipated by Sir William Petty, who, in his "Quantulumcumque, or a Tract concerning Money" (1682), successfully combats the popular idea that England would be drained of cash by an unfavourable balance of foreign trade, and emphatically condemns laws to regulate the rate of interest. He also agrees with the philosophers Hobbes and Locke in their conception of labour as the grand source of value, and consequently of wealth. The latter, indeed, in his "Essay on Civil Government" (1689), says that of the products of the earth useful to the life of man, "we shall find that in most of them, rightly considered, ninety-nine hundredths are wholly to be put to the account of labour"—an evidence of noteworthy progress in the scientific analysis of production. The anonymous author of "Britannia Langens" vigorously opposed the Navigation Acts, but was not in favour of free trade. Another anonymous writer, in "Considerations on the East India Trade" (1701), propounded, more competently even than Dudley North, the theory of free trade. We must not omit to mention also Pierre de la Court, a Dutch writer, whose "Maximes Politiques" contain very broad ideas on commercial policy, and were for a long time attributed to De Witt.

These writers then combated the ideas more generally received, but their teachings had very little effect at the time, although they probably had a strong influence on Adam Smith and the physiocrats of nearly a century later. The principal exponents and supporters of the mercantile system were in England, Thomas Mun, of whom we have already spoken, whose works came to be looked upon as text-books; in France, Antoine de Montchrétien, Sieur de Vatteville, who wrote a voluminous work ("Traité de l'Economie Politique," Paris, 1615), dealing especially with theories relating to commerce and to colonies; in Italy, Antonio Serra, a Calabrian, who, although a believer in

the balance-of-trade system, with more perception than the ordinary mercantilist, showed that money can only abound in those states where happy external conditions, the industry of the inhabitants, and the stability of the government favour the development of manufactures and commerce. The followers of the mercantile system were very numerous in the second half of the seventeenth century, especially in Spain and Germany, but they merely repeat the commonplaces of the system in its grosser form.

The history of the first half of the eighteenth century shows little progress in economic science as a whole. The crude ideas and exaggerated applications of the restrictive system gained in importance, and to the blind faith in the influence of money on national wealth there was added, for a time, an equally absurd confidence in the miracles to be worked by its substitutes, especially the bank-note. The famous John Law proposed to revive the industry of Scotland, which he conceived to be languishing for want of money to employ it, by establishing a great national bank, which he seems to have imagined might issue paper money to the whole value of all the lands in the country. The Parliament of Scotland fortunately declined to carry out his scheme, which, however, with some variations, was adopted by the Duke of Orleans, regent of France, and from 1716 till 1720 he controlled the finances of that country, making extreme abuses of credit, and raising for a time the most extravagant expectations, which soon ended in the greatest disappointment and ruin.

As the progress of a science is often, though not always nor everywhere, attended by progress in its public teaching, we may notice that during the first ten years of the eighteenth century economic theories began to be a subject of academic lectures. In Scotland Francis Hutcheson, professor of moral philosophy at Glasgow (1729-47), in dealing with philosophical and political law, was led to illustrate certain points of economic doctrine, and especially the theories of value and price; but his views, which were derived from the work of a German named Samuel Puffendorf, have little intrinsic value. In Germany, King Frederick William I. of Prussia founded, about 1727, for the instruction of officials, two chairs of Chamber-sciences (so named because the upper administrative departments were called chambers), which included those few theories of general economics and finance out of which the economic science afterwards arose. But the best writers during this period are to be found, not in Germany, but in England, France, and, up to a certain point, in Italy.

In England the idealist philosopher Berkeley, in his periodical publication, *The Querist* (1735), marked the point of departure for a fresh awakening of economic studies, which had been neglected during the first few years of the century. The French economists at the beginning of the eighteenth century deserve to be placed before those of other nations, if we judge them by their width of view rather than their exposition of particular theories. The famous Marshal de Vauban in his "*Dixme Royale*" (1707), painted in bold and vivid colours the misery into which France had fallen during the last years of Louis XIV., and proposed a thorough reform of the system of revenues. His friend Pierre le Pesant, Seigneur de Boisguillebert, was the author of various writings—"l'*Factum de la France*" (1707), "*Traité des Grains*," &c.—and he gives an analysis of the nature and characteristics of wealth, which, though good in many respects, shows the effect of a reaction against the mercantile system in the small importance attributed to money. He demanded free exportation of corn in the interest of the agricultural classes, but wished to restrict its importation, hoping by those means to raise the price of food, and with it the value of land.

In Italy Archdeacon Salustio Antonio Bandini di Siena advocated similar measures for the benefit of agriculture,

and also the simplification of taxes, which he recommended should be levied from the landowners and paid in kind. His book is principally memorable as having led the way to the reforms of the Grand-duke Leopold II. of Tuscany, who, in 1766, established free trade in grain, and introduced a number of other enlightened measures.

Towards the middle of the eighteenth century the really modern era of economic science began, brought about largely by the progress of philosophy and of the social sciences. The favour with which the various sovereigns of Europe began to look upon it contributed also to its advance.

The chairs of Chamber-sciences were multiplied in Germany and Austria, where Sonnenfels in particular, the professor at the University of Vienna, expounded a modified mercantilism, and suggested reforms greatly in advance of the times. A little later chairs of political economy were founded at Naples, Milan, and other places in Italy. But at all these, as well as by a number of writers, including Sir James Steuart, whose "*Inquiry into the Principles of Political Economy*" we quoted from at the beginning of this article, the doctrines of the balance of trade were given forth.

The foundations of a genuine system of political economy, or rather of social science, considered more especially from the economic side, were laid by an illustrious school of French writers living in the reigns of Louis XV. and Louis XVI. François Quesnay, the founder of this school, and his followers, are generally spoken of as the Physiocrats, from their reverence for *natural laws*. Quesnay (1694-1774) was one of the best surgeons of his time, and afterwards devoted himself to medicine, on which he wrote some able works. He bought the appointment of doctor to Louis XV., who became much attached to him. It was only in 1756, when he was sixty-one, that Quesnay wrote for Diderot and d'Alembert's great *Encyclopédie* the two articles, "*Fermiers*" and "*Grains*." These contain the germs of the new doctrine. They consist of an apology for agriculture and a defence of the interests of the peasants, who suffered from feudal exactions, want of capital, the numerous trade monopolies, and from the prohibitions and high duties on the exportation of agricultural produce, not merely to foreign countries, but also in a lesser degree from one province to another. To remedy these evils the author demands full liberty for cultivation and trade. In subsequent works Quesnay elaborated and systematized his views, and finally, in the "*Droit Naturel*" (1768), he attempts to connect his economic theories with the current philosophical ideas relating to law and politics. The main principle of his system is the supreme importance of agricultural industry, which, in his view, is alone productive—that is, it yields a net produce equal to the difference between the gross produce and the expenses of cultivation. This net produce is at the disposal of the farmer, those portions being deducted which are respectively claimed by the landlord (rent) and by the state (taxes). Manufacture, he held, merely increases the value of commodities already existing, by an amount equal to the value of the labour expended on them. Hence manufactures, and, for the same reason, trade, are regarded as barren and unproductive industries. The wealth of a country, Quesnay maintained, is not increased by money, which is the mere instrument of exchange, but by an abundant produce from its soil. Applying his principles, Quesnay demanded complete liberty for cultivation, and for the sale, both at home and abroad, of the products of the soil; the abolition of all restrictions by which cultivators were bound; the multiplication of roads; the spread of instruction; the grant of encouragements and rewards. Manufactures and trade were also to be freed from all hindrances to their full development, so that competition might lower the price of manufactures for the benefit of the farmers, who could thus increase their gains.

Quesnay condemned the system of indirect taxation as unjust and harmful, since all burdens on production must, in the end, according to his theories, fall on net produce, and he therefore advocated a single direct tax on land rent as being the most rational and the least costly form of taxation. This new teaching very soon became popular among the cultured classes in France, and although the exaggerations of some of Quesnay's admirers aroused strong opposition, the effect of physiocratic doctrine on subsequent events and ideas was very considerable.

Among the pupils and admirers of Quesnay was the Marquis of Mirabeau, *l'ami de l'homme*, and many of the encyclopædists, including Condorcet and Jean Jacques Rousseau, adopted his views more or less fully. There were several followers of the system, both in Germany and Italy, but none of striking merit. The physiocratic school had little influence in England, where the illustrious philosopher and historian, David Hume, published his economic essays in 1752. In these he treats, with much originality and ability, of commerce, of money, of commercial jealousies, of the balance of trade, of interest, of taxation, and of the public debt.

In France Jean Vincent Gournay, a learned merchant of St. Malo (1712-59), afterwards in the service of the government, arrived independently at much the same opinions as Quesnay, though he denied the latter's assertion of the barrenness of manufactures and commerce. He is well entitled to mention, if only for the sake of his well-known aphorism of *laissez faire, laissez passer*, which pithily summarizes the creed of his school, and that of many economists still.

As one great French minister, Colbert, was the first to apply mercantilist principles on a large scale in the seventeenth century, so to another in the eighteenth belongs the honour of having attempted the application of the new economic principles. Turgot first made the experiment on a small scale, as Intendant of Limoges from 1761 to 1774, when Louis XVI. appointed him minister of finance. In this capacity he instituted several reforms, the most notable being the freedom of trade in grain in the interior, the suppression of corporations, and the abolition of the *corvée*. But these measures excited so much opposition at court, and among all who profited by the abuses of the existing system, that in 1776 he was compelled to retire, and his reforms were shortly after withdrawn. His principal work was a masterly exposition of the physiocratic theories in his "*Réflexions sur la Formation et la Distribution des Richesses*," written in 1766. It may be considered as the best economic treatise that had yet been published, both for the worth—at least the comparative worth—of its theories, and the brevity, clearness, and elegance of its style. It was Turgot who first clearly separated economics from politics, law, and ethics, with which it had previously been confounded.

Of the continental opponents of the physiocratic school Genovesi, the professor of political economy at Naples, was the most learned, and summed up the older learning on the subject, but did not help in its further progress. Giammarco Ortes (1713-90), a Venetian priest, was the most illustrious of the Venetian economists of the last century, and is principally remarkable for having, to a large extent, anticipated the doctrines on population expounded by Malthus a few years later.

In England, however, or rather in Scotland, the production of Adam Smith's great work on the "*Wealth of Nations*" (1776) marks an epoch in the history of political economy. As his life and works will be found described more particularly elsewhere [see SMITH, ADAM] we need only endeavour here to estimate his position among the great economists of his age and his influence upon those who have succeeded him. He undoubtedly takes the first place among the economic writers of his century. He

gathered together and co-ordinated all existing materials relating to individual theories, gave a better form to many, and enriched the science with several hardly approached before his time. He corrected the exaggerations of the physiocratic school, while retaining whatever was good in its system. Perhaps his greatest contribution to economic science, and to the world, was his minute and crushing refutation of all the arguments commonly used in favour of mercantilist teachings current in his time. The whole commercial legislation of the world was framed on the doctrines of protection; all financiers held them, and the practical men of the world were fixed in the belief of them. "There were many Free-traders before Adam Smith, both writers and men of business," says Bagehot in his "*Economic Studies*," "but it is only in the antiquarian sense in which there were poets before Homer and kings before Agamemnon. There was no great practical teacher of the new doctrine; no one who could bring it home to the mass of men; who connected it in a plain, emphatic way with the history of the past, and with the facts of the present; who made men feel that it was not a mere 'book-theory,' but a thing which might be, and ought to be real. And thus (by a good fortune, such as has hardly happened to any other writer) Adam Smith is the true parent of Mr. Cobden and the Anti-corn-law League, as well as of Ricardo and of accurate political economy." The extent of his influence is strikingly illustrated by the fact that M. Mollien, the wise finance minister of the first Napoleon, avows "that it was the book of Adam Smith, then so little known, which taught me better to appreciate the multitude of points at which public finance touches every family, and which raises judges of it in every household." We owe it to Adam Smith, that since his time the great principle of Free-trade has been embodied in the science, and has been expounded and defended by most economists. So little, however, did he anticipate even the partial triumph of this principle involved in its adoption as the cardinal doctrine of English policy that we find him saying—"To expect, indeed, that the freedom of trade should ever be entirely restored in Great Britain, is as absurd as to expect that an Oceania or Utopia should ever be established in it. Not only the prejudices of the public, but what is much more unconquerable, the private interests of many individuals, irresistibly oppose it." By the work of Adam Smith political economy gained a definite position among the social sciences, and acquired a definite object. But it must not be thought that the new science was perfectly constituted by him. He neglected some of the most important economic theories, such as population and international exchange, while in regard to rent he fell into the error of supposing it to form part of what he calls the "natural price" of commodities; and in dealing with value he endeavoured to prove that "labour, never varying in its own value, is alone the ultimate and just standard by which the value of all commodities can at all times and places be estimated and compared"—an obviously erroneous doctrine, which will be found more fully dealt with in a separate article. See VALUE.

During the fifty years which followed the publication of Smith's book the theories for which he pleaded did not find a ready or a wide acceptance in practice, but they were taken up by a body of able men, first in England, then in France, Germany, and throughout the Continent, who set themselves to arrange, to complete, and in some particulars to rectify them. The first of these writers was Thomas Robert MALTHUS (1766-1831), whose name is identified with the theory of population, which he expounded in his famous essay, published in 1798, and which mainly led to the reform of the English Poor Law. [See POOR LAW.] It was evoked by Godwin's plan of village perfection, in which every road was to maintain its man, and in which mankind were to be happy and at ease,

without the annoying restraints of property and marriage. Malthus replied—"You may imagine this perfect picture for a little while, but it will not last. It cannot last. Nature is against it. She has a principle—that of population—which is sure to destroy it. Mankind always, by her arrangements, increase as fast as they can; misery checks their increase, and vice checks it, *but nothing else*. A perfectly happy and virtuous community, by physical law, is constrained to increase very rapidly; if you look into the fact you will find that it will double every twenty-five years, but there can be no similar increase in their food. . . . By nature human food increases in a slow arithmetical ratio; man himself increases in a quick geometrical ratio unless want and vice stop him." Such a dismal doctrine, put forth with so much precision and confidence, and by a clergyman too, naturally received much criticism, although the general disappointment which had followed the bright hopes kindled by the first steps of the French Revolution had prepared the way for its acceptance in many minds. The principal objection made was the impossibility of reconciling such a theory with the belief in a benevolent Creator, and Malthus seems to have reconsidered his views, with the result that in the second edition of his essay he takes into account "another check to population which does not come under the head either of vice or misery." This is the celebrated principle of "self-restraint, moral or prudential." This modification brings his doctrine more into accordance with the facts, but obviously destroys much of its force as an argument against Godwin. The painful side of the doctrine having alone been put forward at first, the public mind became fixed upon it, and for many years could see no other. The other economic writings of Malthus are of little merit, and need not detain us. Another illustrious English economist, DAVID RICARDO (1772-1823), was the true founder of abstract political economy, by his work "On the Principles of Political Economy and Taxation." He is, however, principally known for his treatment of the theory of rent, a subject which had been, as before remarked, a stumbling-block to Adam Smith. In discussing the latter's statement that rent forms one of the component parts of the price of raw produce, he defines rent as "that portion of the produce of the earth which is paid to the landlord for the use of the original and indestructible powers of the soil" as distinct from the interest and profit of capital, represented by farm buildings, improvements, &c., with which it is often confounded. And he goes on to show that the price of agricultural produce being practically the same as the cost of raising and bringing it to market from the least productive soils actually contributing to the supply of the market, there remains on all the more productive fields a surplus which the owner has the power to insist upon receiving, and which constitutes rent.

It is clear that if the price of agricultural produce, through the absence of effective demand, were to fall below the price at which it would pay the farmer who worked under the least favourable conditions of soil to raise and bring it to market, he would cease to do so, and inferior land would gradually go out of cultivation, until the cost of production once more corresponded with the price obtainable. While on the other hand, if the price of produce were to rise, poorer or less favourably suited fields would successively be brought under cultivation as long as the market price afforded a fair return for the labour and capital employed in cultivation. Such, put in its barest and briefest form, is the economic doctrine of rent which is associated with the name of Ricardo, its ablest exponent. It had been correctly stated by Dr. Anderson, a Scotch writer, in 1777, but attracted no attention. Malthus had perceived it too, but so imperfectly that he founded an argument in favour of duties on the import of foreign corn, upon the very grounds on

which Ricardo advocated the freedom of the corn trade. See RENT.

To a French writer, J. B. Say (1767-1832), belongs the merit of having developed in a clear, orderly, and attractive manner the truths contained in Adam Smith's work, and his "Traité d'Économie Politique" (1803) made them familiar to the learned men of Europe. In Germany, Holland, Switzerland, and Hungary, Smith had numerous interpreters and disciples, among whom may be mentioned Count Hogendorp in Holland, and the illustrious Sismondi in Switzerland. Franklin and others discussed his views in the United States, and even in Brazil they attracted attention, and Da Silva-Lisboa sought to adapt them to the circumstances of another civilization.

Political economy now became almost a popular study in England. From Ricardo the science passed to a whole set of minds who based themselves with working out his ideas, and elaborating and completing them. For five-and-twenty years England was full of discussions on economic questions. The writings of Thomas Tooke (1773-1858) were partly contemporary with, and partly later than, those of Ricardo. He was the author of the celebrated "History of Prices," continued by William Newmarch; a work which is a rich storehouse of facts and theories on the doctrine of circulation, and more especially that of credit. Colonel Torrens (1784-1864) was the author of an "Essay on the Production of Wealth" (1821). He maintained with Lord Overstone, Norman, and others, those restrictive theories with regard to banks of issue which formed the basis of the famous Act of 1844, that increased the privilege of the Bank of England. J. R. McCulloch, a learned and laborious writer, published manuals of economics and finance, of no particular importance, but he did valuable service by his bibliography of the English writers on all questions connected with these subjects. A more original and acute thinker was Nassau W. Senior (1790-1864), twice professor at Oxford, in 1826 and 1847. He wrote several very interesting monographs on the cost of production, absenteeism, and especially on the international distribution of the precious metals. He is less favourably known in connection with his "wages-fund theory," which is now almost completely disproved and abandoned. The most prominent place among modern English economists undoubtedly belongs to John Stuart Mill (1806-73), and this he owes not only to the intrinsic value of his writings on the subject, although that was very great, but also to the fact that his principal work was produced at a time when it seemed that the science had at length emerged from the state of polemical discussion to that of fundamental notions and principles. And although, as a rule, one of the last men to over-estimate the value or finality of his work, it is evident that he himself held this view, for he begins his account of value by saying, "There is nothing in the laws of value which remains for the present or any future writer to clear up: the theory of the subject is complete." See MILL, JOHN STUART.

The lively interest in political economy, due in part to the depression and suffering of the first part of the present century, and the great increase in prosperity which followed the tariff reforms begun by Huskisson in 1825, and crowned by the repeal of the Corn Laws in 1846, gave the science a position and authority in the popular estimation which it had never enjoyed before. There were still loud voices on the opposite side, but comparatively little notice was taken of them in this country. The facility with which in 1869 Mill resigned the old wages-fund theory which he had taught for years, when it was attacked by Thornton in his book "On Labour," gave a great shock to the public confidence in the conclusions of economic science, and naturally led to a more ready ear being given to other utterances of dissent from economic orthodoxy. A second

shock was given in 1871 by the publication of Professor Jevons' "Theory of Political Economy," in which the very theory of value asserted by Mill to be "complete" was successfully attacked, and a more precise and comprehensive theory substituted for it, which, except as to its mathematical form, has been practically adopted by some of the best English writers since. Even Prof. J. E. Cairnes' work, "Leading Principles of Political Economy" (1874), though written by a disciple of Mill, and in fundamental agreement with his doctrines, still contributed to impair the unique prestige which Mill's exposition had continued to enjoy for nearly half a generation. "In short," to quote from the introduction to Professor Sidgwick's "Principles of Political Economy" (1888), "when the concluding quarter of this century began, it was evident that political economy had returned to the condition in which it was in the second quarter; and that McCulloch's melancholy admission that the differences which have subsisted among the most eminent of its professors have proved exceedingly unfavourable to its progress, and have generated a disposition to distrust its best established conclusions, was again only too applicable."

A new school of economists which came into prominence in Germany about 1870, called the Professorial Socialists (*Catheders-socialisten*), and of which Mr. Cliffe Leslie has been the chief exponent in England, are generally agreed in repudiating as "Manchesterism"—or even "Smithianism"—the view of political economy mainly adopted in England; and uphold the English school with an absurd devotion to the *a priori* method. So that in addition to disputes as to particular doctrines, there has now arisen a more fundamental controversy as to the general method of dealing with economic questions. Finally, the practical success of Free Trade has latterly been called into question by an apparently growing party of practical men, whose position has been strengthened by the falsification of Cobden's confident assertion that in ten years after England set the example, Free Trade would be adopted by the whole civilized world. Among the more recent English writers on economics, the late Professor W. Stanley Jevons is probably the most original. In his "Theory of Political Economy" he made the theory of value already referred to the basis of a systematic application of mathematics to economic investigations; and, besides a number of minor productions, was the author of "Money and the Mechanism of Exchange" (1875), a work abounding in facts and very important technical illustrations. The late Professor Fawcett, of Cambridge, was the author of an excellent and very popular "Manual of Political Economy" (1863, fifteenth edition, 1876), of the orthodox school. It is a compendium of Mill's "Principles," enriched by special development of many questions of practical life, such as trades' unions, co-operative societies, local taxation, land nationalization, &c. Although Fawcett contributed little or nothing to the theory of political economy, he nevertheless did the science very important service. His courage and tenderness, his force and clearness of thought, and his devotion to fact, enabled him to deal with the application of abstract theory to practical questions with a remarkable firmness of grasp and lucidity of expression, and, at the same time, with an obvious sympathy for the suffering and an openness of mind—a readiness to learn—which remained with him to the last. As his successor at Cambridge, Professor Marshall, said in his inaugural address in 1885—"He was able to take a position which no other economist has held; he was able to tell the people unpalatable truths, and to earn their hearty thanks for doing so. The working classes saw in him the friend of the weak and the oppressed, the chivalrous pleader for the agricultural labourer and the Indian ryot; and they listened to him with something more than forbearance when he taught the hard doctrine that they must in the main work out their

own social salvation by their own efforts." Mrs. Fawcett, who assisted her husband in his work, gathered together its doctrines in a little book called "Political Economy for Beginners" (1870). Another excellent compendium is that by Professor Marshall, of Cambridge, and his wife—"The Economics of Industry" (1879), in which the newer school of thought is represented. The best recent work on banking subjects is undoubtedly "Lombard Street" (1873), by Walter Bagehot (died 1877), who describes with remarkable clearness the varied and complicated processes of the elaborate monetary and credit system which has reached such a high pitch of development in recent times, especially in London. The same writer's "Economic Studies" contain very valuable essays on the "Postulates of Political Economy," and on Smith, Malthus, and Ricardo. Professor J. E. Thorold Rogers has done good work in his "History of Agriculture and Prices in England," and his "Six Centuries of Work and Wages." The most recent statement in this country of the "Principles of Political Economy," is the work of that name by Prof. H. Sidgwick, published in 1888. "It is written," as he says in his introduction, "in the belief that the reaction against the treatment of political economy as an established science was inevitable and even salutary; but that it has been carried too far, so that the waves of disputation are in danger of submerging the really sound and valuable results of previous thought." And the author is of opinion that the valuable contributions to abstract economic theory by Jevons, Cairnes, and others, "admit of being stated in a form decidedly less hostile to the older doctrines," and that "the antithesis between the inductive and deductive methods has been stated by writers on both sides in needlessly sharp and uncompromising terms"—both modes of treatment being necessary in dealing with different branches of the science. Among the writers in English, though not among English writers, we must mention an excellent American economist, Mr. F. A. Walker, the author of a treatise on "Political Economy" (London, 1883), which is probably the best survey of the whole field of political economy in the language, and special works on "The Wages Question," "Money," and "Land and its Rent," the last being a vigorous defence of the Ricardian theory, and a reply to the attack of a fellow-countryman, Mr. Henry George, in his somewhat sensational work, "Progress and Poverty," upon the principle of private property in land.

Although political economy has never been popular in France, being warmly opposed by protectionists on the one hand and socialists on the other, that country can boast of a number of excellent economists in the present century, and in the "Dictionnaire de l'Economie Politique," edited by Courquelin and Guillaumin (1851-53), possesses an alphabetical encyclopædia of economic science which no other country can rival. Frédéric Bastiat (died 1850) is probably the French writer best known outside his own country. Fired by the success of Cobden and the English Corn-law League, he wished to become the apostle of Free Trade in France. His powers of railery and sarcasm were very great, and in his "Sophismes Économiques" (1846-47) he overwhelms the protectionists with a happy combination of argument and ridicule. He also attacked socialism with some success, but in his attempt at constructive work, "Harmonies Économiques" (1850), he was much less fortunate. Among recent French economists, Michel Chevalier (died 1879) stands first. He was a brilliant writer, and in addition to a "Cours d'Economie Politique," was the author of a number of other writings on the depreciation of gold, banking, &c. His name, too, is indissolubly connected with the treaty of commerce concluded between France and England in 1860, which he took a leading part in arranging. There are also many authors of treatises and compendiums of political economy, of which the "Traité, théorique et pratique, d'Economie

Politique" (1858), by Courcelle-Seneuil, Mill's translator, is certainly the best. M. Joseph Garnier, editor of the *Journal des Economistes*, is the author of a text-book, entitled "Traité d'Economie Politique Sociale ou Industrielle" (eighth edition, 1880), a compilation which, though not perhaps very profound, contains many dates and interesting biographical and other details, of which the present writer has taken advantage. The work of the distinguished mathematician, Cournot (died 1877), "Principes de la Théorie des Richesses" (1863), is specially noteworthy for the application of algebraic analysis to economic investigations.

In Germany the progress of economic science has been very remarkable during this century. Among those who have been in the main faithful to the school of Adam Smith, the first place doubtless belongs to Karl Heinrich Rau (died 1870), professor at Heidelberg, and the author of an exhaustive work on political economy, rich in statistical and bibliographical illustrations, and paying special attention to the application of economics to the administration of the state. His work, the first volume of which appeared in 1826, was used as a text-book in the principal universities of Germany, and till 1854 it met with no serious opposition. After Rau, the widest influence on the progress of economic investigations in the first half of the century was exercised by Friedrich B. W. Hermann (died 1869), whose "Researches" appeared in 1832. His analysis of the theories of production, capital, prices, rent, profits, and consumption has enriched the science with useful demonstrations and important corrections which have been very valuable to later economists.

The second half of the century has been distinguished by the formation of several new schools of economists in Germany. There are the Social Conservatives, who occupy themselves especially with the condition of working men, for the improvement of which they, in opposition to the orthodox economists, advocate state interference. Wagner, the author of a political Conservative dictionary, and Professor V. A. Huber, the unwearied promoter of co-operative societies and a voluminous writer on the subject, belong to this school. R. Meyer, a journalist, also belonged to it, and wrote a work on what he calls the "Struggle for the Emancipation of the Fourth Estate" (published 1874), which is remarkable for the abundance of facts which it contains. Then we have what is known as the Historical school, under the leadership of the famous Professor Roscher, of Leipzig, author of a remarkable treatise, in which he has gathered together valuable materials from classical literature, from historical, geographical, and statistical works, and from books of travel, to illustrate the various phases of economic civilization in nations, and to show that legislation ought to take these varieties of culture into account. This is exceedingly interesting and valuable, especially as a corrective to the teachings of the doctrinaires and idealists, who think that the result of their abstract speculations can be directly applied without taking the circumstances of time and place into consideration. But Roscher himself, to some extent, fell into the error of denying the existence of general economic laws, or at least underrating their importance, while some of his followers, as often happens, have greatly exaggerated the tendencies of their master. They believe only in historical and relative laws, discovered by the inductive method, and deduced from simple psychological and abstract premises, and they assign a large sphere to the modifying action of the social power. The growing importance of the socialist movement in Germany has led to their giving special attention to questions concerning the distribution of wealth, and endeavouring at least to help on the solution of the "social question." Professor Adolf Wagner, of Berlin, is the leader of what are called the Professorial Socialists in this latest development of the historical school, and along with him

stand most of the professors of economics in the German universities.

There are besides some minor schools, numbering among them many eminent writers, to which our space will not permit us to refer. Holland and Belgium have produced a number of excellent writers on economics, of whom De Laveleye, professor at Liège, is the best known. His works on "Primitive Property" and on "Agriculture in Switzerland and Belgium," are specially worthy of study. Switzerland can boast of several illustrious economists. G. C. L. Sismondi (died 1842), expounded Adam Smith's theories in his book, "De la Richesse Commerciale" (1803); but in a later work, alarmed at the dangers which accompany economic progress, and caring much for the well-being of the working classes, he attacked the division of labour, machinery and competition, in a way of which the socialists have not failed to make use. The Genevese writer, A. E. Cherbuliez (died 1869), was the author of many economic writings, his most important being the "Précis de la Science Economique" (1862), the best treatise on economic science in the French language; and M. Léon Walras (professor at Lausanne), in his "Éléments d'Economie Politique Pur" (1874), has made a very important contribution to the mathematical treatment of the subject. No writers of international repute on economic questions have appeared in Spain and Portugal; but Italy, although not so conspicuous in this respect as at former periods, has not been without some important writers on political economy in the nineteenth century, the most influential being Francesco Ferrara, a professor at Turin from 1849 to 1858, and Dr. Cossa, who has been since 1858 professor of political economy in the University of Pavia, and whose "Guida allo Studio dell'Economia Politica," first published in 1876, and translated into English under the auspices of Professor Stanley Jevons in 1880, "presents," to quote Professor Jevons, "in a compendious form, not only a general view of the bounds, divisions, and relations of the science, marked by great impartiality and breadth of treatment, but it also furnishes us with an historical sketch of the science such as must be wholly new to English readers," and to which the writer of this article has been greatly indebted.

POLIZIANO, ANGELO or AGNOLO, one of the greatest poets and classicists of the age of Lorenzo de' Medici, born 14th July, 1454, at Montepulciano (in Latin, *Mons Politianus*), Tuscany, whence he assumed his literary designation, his own family name being Ambrogini. His father was a doctor of law in poor circumstances. Poliziano was amazingly precocious, writing his best in boyhood, and transcending all his contemporaries in literary aptitude. He wrote Latin epigrams at the age of thirteen, and Greek at seventeen. His longest, and generally, though unwisely, termed his finest Italian poem, upon a joust held by Giuliano de' Medici (*Giostra de G. de' Medici*) was written at the age of fourteen. These first-fruits of genius were either the motive, or possibly the result, of special care bestowed by Lorenzo de' Medici upon the education of Poliziano. Lorenzo continued till his death, at which Poliziano was present (1492), to evince extreme attachment towards the poet, committing to him the education of his son Pietro, and perhaps also of Giovanni, afterwards Leo X., and keeping him permanently in his own house. Poliziano was professor of Greek and Latin in Florence at twenty-nine years of age, and his lectures attracted scholars from all parts of Europe. He was also well versed in Hebrew. After Lorenzo's death he received a canonicate in the Cathedral of Florence, and entered holy orders, although a taint of atheism always clung to his name. This stigma seems to moderns quite undeserved. He died on 24th September, 1494, the day when Charles VIII. of France entered Florence in triumph; being carried off in his forty-first year by a fever, supposed to have been aggravated by sorrow at the fall of the Medici. His

morals appear to have been bad, and his amours especially notorious, although spleenetic, carping, and arrogant, and in person ugly, with a squint and a disproportionately long nose. This repulsive figure of Poliziano the man is the antipodes of Poliziano the poet. His poetic faculty, in lyrics and short pieces at least, is certainly the greatest in Italian literature after the time of Petrarca. In writing of love and women, his chief theme, he is exceptionally devoid (considering his period) of grossness; his grace of sound and cadence is quite peculiar; his sallies are full of charm and archness, with an exquisitely natural and almost modern tone; and he is markedly free for so profound a classicist from any of the insipidities of learning. His lyric drama of "Orpheus" (1483) is the earliest example of the Italian opera. Among his other works may be specified a Latin "History of the Conspiracy of the Pazzi;" Latin translations of Herodian and many other Greek historians and poets; a comment on Justinian's Pandects, published in 1762; a highly erudite volume of "Miscellanea," containing explanations and corrections of a great number of passages from the Latin classics, &c.

POLK, JAMES KNOX, President of the United States, was born in North Carolina, 2nd November, 1795. After the usual course of education, he entered the legal profession, and in 1820 became a member of the bar. In 1825 he was elected a member of Congress, where he was three times chosen speaker. His opinions were democratic, and by that party, in 1841, he was chosen president of the republic. He proved himself a judicious and energetic ruler; and it was during his administration that the Texas were annexed to the United States, and the war against Mexico successfully terminated. He died on 15th June, 1849. (See "Life of the Hon. James Knox Polk, with a Compendium of his Speeches," 1844; Chase, "History of the Polk Administration," 1850.)

POLKA, a very popular round dance. It is of Bohemian origin, and was the invention of a servant girl, Anna Slezak, living at a farmhouse at Elbeteinitz, near Prag, a clever dancer; the music being written by a local fiddler called Neruda. The dance was composed of various steps, alternately slow and graceful and quick and decisive, with certain little half-steps or pauses, whence its later name of *Pulka* ("half"). Its original name was "Nimra," the name of the song to which it was danced. It was locally known in 1830, and by 1835 had spread to Prag. A military band took its spirited tune to Vienna, and the dance was soon as popular as the tune; and in 1841 it reached London. Here it obtained a most extraordinary vogue. Hats, cloaks, houses, and streets were named after it, and the "polka mania" supplied the comic papers with subjects for their wit.

As first danced in London at the Opera-house by Cerito, &c., the polka had five figures, one of them being a very effective heel-and-toe step, found rather difficult by ordinary dancers. All the figures but one have disappeared, and this is the simplest possible; it consists only of three steps in each bar (the music being in $\frac{2}{4}$ or half-common-time) and the fourth quaver of the bar is left as the characteristic pause of the dance, so that the dancers begin the bars alternately with the right and the left foot. The omission of the fourth quaver of the bar gives a peculiar brilliancy to good polka-tunes, but the effect is so marked as easily to become vulgar, when not cleverly masked by the skill of the composer. Requiring far less skill than the waltz, while still allowing couples to gyrate to their hearts' content, the polka as now simplified retains to this day a very great popularity.

POLL TAX, or CAPITATION TAX, a tax levied upon every individual, was in use among the ancient Romans. It was first levied in England in 1379, and occasioned, two years later, the rebellion supposed to have been headed by Wat Tyler. It was again levied in 1513.

A capitation tax was also enacted by the 18 Charles II. (1667), at the rate of £100 for a duke, £80 for a marquis, £30 for a baronet, £20 for a knight, and 12*d.* for every private person. William III. abolished it after the Revolution of 1688.

POL'LACK (*Gadus pollachius*) is a fish belonging to the family GADIDÆ, and nearly allied to the whiting, from which it is distinguished by having the lower jaw projecting beyond the upper. It is about the same size as, and has a general resemblance to another near ally, the coal-fish. It is beautifully marked, the back being dark green, the sides lighter and streaked, and spotted with yellow, and the belly nearly white. The pollack is very abundant off the British coasts during the summer; in Scotland and in some parts of Ireland it is called *Lythe*. It is caught in great numbers by artificial flies. The flesh is eaten, but is not considered equal to that of the whiting.

POLLAIUO'LO, ANTONIO, one of the most distinguished of the earliest Florentine painters, was born about the year 1430. His first master was the goldsmith Bartoluccio. Antonio attracted the notice of his master's stepson, the great Ghiberti, who afterwards employed him as one of his assistants in the modelling of the second pair of gates which he made for the baptistery of Florence. Pollaiuolo established himself as a goldsmith, and he soon acquired also a great reputation as a statuary or sculptor in bronze. He was remarkable as a skilful modeller, and is distinguished as having been the first artist to dissect the human body for the purposes of art. It is, however, as a painter that Antonio Pollaiuolo has transmitted his name to posterity. His brother, Piero Pollaiuolo, who was ten years younger than Antonio, was educated as a painter under Andrea del Castagno, and this circumstance probably led Antonio to take up painting also. They worked together; and their masterpiece is the fine large altar-piece now in the National Gallery, representing the martyrdom of St. Sebastian, and distinguished for its admirable drawing of the figures, unrivalled by anything of its own date—the year in which Michelangelo was born. Another work in the National Gallery, the "Virgin adoring the Infant Christ," ascribed to Domenico Ghirlandajo, is now generally attributed, with much more probability, to Pollaiuolo. In 1484 Antonio was invited to Rome by Pope Innocent VIII., for whom he executed important monumental works, among them a monument to Sixtus IV., in the old church of St. Peter. He died at Rome early in the year 1498; Piero, his brother, had died nine years before.

POLLAIUO'LO, SIMONE DEL or **SIMON MASI**, called also *Il Cronaca*, from his fondness for narrating, an eminent Italian architect, was born at Florence in 1454. He studied at Rome, measuring carefully all the ancient buildings in that city. On his return to Florence he was employed by Strozzi to complete his palace, begun in 1489 by Benedetto Maiano. Pollaiuolo also built the council hall of the Signoria at Florence, the church of San Miniato al Monte, outside Florence, a building greatly admired by Michelangelo, and other famous buildings. He was a follower of Savonarola. He died at Florence in 1509.

POL'LAN (*Coregonus pollan*) is a fresh-water fish, of the family Salmonidæ, found in the Irish lakes. It is particularly abundant in Lough Neagh, and is taken in great numbers when it comes in large shoals into shallow water for the purpose of spawning. It is 10 or 11 inches long, with a short head and deep body. The back is dark blue and the belly silvery, while the fins are tinged with black at their extremities. The flesh is of good flavour. See **COREGONUS**.

POL'LEN, characteristic of the flowering plants or Phanerogamia, presents to the naked eye the form of a fine powder, contained in the cells of the **ANTHER**, by whose

action on the stigma the ovules are fertilized. The *pollen-grains*, or separate particles of pollen, are developed in the pollen-sacs of the anther, and in the common flowering plants, the Angiosperms, consist each of a single cell with two coats, the outer of which, the *ectine*, is cuticular, often coloured and variously marked, while the inner, the *intine*, consists of pure cellulose. When the pollen-grain is applied to the stigma the extine gives way in one or more places, and the intine protrudes as the *pollen-tube*, which makes its way through the substance of the stigma to the ovary, enters the ovule by the micropyle, and fertilizes it. The emission of the pollen-tube, called pollination, often precedes by a considerable period the act of fertilization. In some orchids the ovules are not formed when the pollen-tube is first emitted, several months being necessary for it to grow down into the ovary. In the Gymnosperms (conifers, &c.) the pollen-grains consist of two or more cells inclosed in a common extine, the larger cell forming the pollen-tube. See FERTILIZATION.

POLLIO, CAIUS ASINIUS, was born at Rome, 76 B.C., and early in life attained distinction as an orator. On the commencement of the Civil War he joined Cæsar in Gaul, and accompanied him in his advance to Rome. He was present at the battle of Pharsalia, and had a share in Cæsar's subsequent campaigns in Africa and Spain. At the time of Cæsar's death Pollio was governor of Further Spain. After temporizing for some time he joined the triumvirs with three legions, about the close of the year 43 B.C. He was soon appointed by Antony governor of Gallia Transpadana, and it was in this office that he saved from confiscation the property of Virgil. As a common friend of both parties, Pollio had a considerable share in bringing about the treaty of Brundisium between Antony and Augustus, 40 B.C. He died A.D. 4, at the age of eighty. As a critic, a poet, a historian, and an orator, Pollio was equally eminent, but all his works are now lost. He was the friend of Catullus, Horace, and Virgil. He was also the first person who formed a public library at Rome. As a critic Pollio was severe, and is especially noted for condemning in the historian Livy a certain Patavinity, probably meaning an inelegant provincial idiom.

POLL'LOK, ROBERT, a Scottish poet and minister, the son of a small farmer, was born in 1799, at Muirhouse, in the parish of Eaglesham, in the county of Renfrew. While pursuing his studies he published three small prose tales, and in 1827, by the advice of Professor Wilson, he published the work by which he is chiefly known, a poem in ten books, on the spiritual life and destiny of man, entitled "The Course of Time." Excessive application had, however, developed a tendency to consumption, and the poet died at Shirley Common, near Southampton, on 17th September, 1827, just as he was beginning to become famous.

His poem exhibits a great command of the English language, and a power of terse, rapid, melodious diction, but, though illumined by many fine passages, as a whole it must be pronounced somewhat monotonous. His memoir, written by a brother, was published in 1843.

POLL'LUX, the Latin name for Poludeukês, in the Greek mythology, the brother of Castor (Kastor) and also of Helena, fair cause of the Trojan War. See CASTOR.

POLLUX, one of the well-known pair of stars forming the chief points of the constellation Gemini (the Twins), is rather brighter than its twin-star Castor. It is a multiple star, and is technically known as β Geminorum.

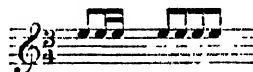
POL'O, a ball game played on horseback. This pastime is of Eastern origin, and was imported into England in 1871 by some Indian officers. It is much played in Tartary, and may be described as hockey on horseback. Two goals, as for football, are placed not less than 250 yards apart, and the object is to drive a ball, about the size of a cricket ball, through the goal by striking it with long sticks having bent or crooked ends. Ponies are

ridden by the players, and a good deal depends on their swiftness and agility, but still more on the skill with which they are managed. Four or five a side are the usual numbers, and those scoring the greatest number of goals win the game.

POL'O, MARCO. See MARGO POLO.

POLONAISE should be, by name, a dance in the Polish style: but it is questionable if it were not of French origin. It is believed to owe its existence to a state reception of Henry of France as king of Poland, the same prince who afterwards as Henry III. ruled his native land. The court danced in a stately way to a sort of march tune, forming a long procession before the new monarch. Thus the polonaise took the character of an opening procession, and it still continues in Germany and elsewhere to fulfil that function at state balls. It is not now usual to dance it, but to walk it in a stately manner.

The rhythm of the polonaise was very varied till Chopin fixed its form to a national Polish figure. This is a movement in $\frac{3}{4}$ time, of great vivacity, but not fast, and with the strongly marked rhythm:—



With this rhythm Chopin has done marvels: his romantic creations are as fresh and bright as the day they were written. He is the unapproached, perhaps unapproachable, master of the polonaise.

POL'SKA, a national Swedish dance, has nothing at all to do with the well-known POLKA of Bohemian origin. The polska has marked resemblances to certain varieties of the Scotch reel; its tunes peculiarly favour the minor keys and quaint snatching rhythms of a wild Norse character. The tempo is $\frac{3}{4}$, but the style is far nearer akin to the Mazurka than the waltz, to use a very rough simile. As a musical form it may be made very fascinating.

POLTA'VA or PULTAVA, a town of Russia, the capital of the government of the same name, is situated near the confluence of the rivers Poltavka and Vorsikla. It is built of wood, but the streets are wide and straight; in the centre there is a good square surrounded with stone houses, and in the middle of it a handsome monument of granite, in honour of Peter the Great, who, on the 8th July, 1709, gained a decisive victory here over Charles XII. of Sweden, after which the latter was obliged to take refuge in Turkey. The town is surrounded by a rampart, and has ten churches (including the cathedral), a convent, a gymnasium, and a school. The inhabitants, 20,000 in number, carry on an extensive trade in the produce of the country. Three large annual fairs are held.

POLYBIOS. See POLYBIUS.

POLUDEUK'ES (*Pollux*). See CASTOR.

POLUDOROS (Lat. *Polydorus*), the youngest son of Priam (Priamos), king of Troy, and Hecuba, his queen (Hekabê). He was despatched by his father, when affairs had grown quite desperate, to the allied King Polymestôr of Thrace, carrying much treasure, that it might be preserved. On the fall of Troy Polymestôr murdered the poor boy and stole the treasure. He threw the body into the sea, which washed it ashore at the foot of his mother Hekabê, who had been taken captive and was being led to slavery. She piously entombed it, and then, assisted by other Trojan captive women, she took a fearful vengeance on the King of Thrace, by murdering his children and blinding himself.

Homer makes Poludôros a son of Priamos by Laotoê, not Hekabê, and narrates his slaughter by Achilles.

POLUGNOTOS (Lat. *Polygnotus*), the earliest of the great painters of Greece, was a native of Thasos, and is assumed to have returned with Kimôn to Athens after the conquest of that place, 463 B.C. With this painter the

art was fully developed in all its essential principles, even to the establishment of portrait-painting. The picture of Kimôn's sister Elpinikê is the first Greek portrait by a known painter on record. Polugnôtos painted her as Cassandra, in the painting of the "Rape of Cassandra" in the Poikilê at Athens. Polugnôtos was distinguished above all his contemporaries for his powers of expression, and Lucian praises the elegance of his flowing draperies. Two very famous series of pictures, known as the Iliad and Odyssey, on subjects chiefly taken from Homer, in the temple of Apollo at Delphi, were treated with extraordinary honour. The painter was granted by the Amphiktuonic Council public hospitality throughout Greece, that is, wherever he travelled he was maintained at the public expense. The original pictures were still in a good state in the time of Pausanias; they were probably on panels and let into the walls.

POLUKLEIT'OS (Lat. *Polycleetus*), a celebrated Greek sculptor, was born at Sicyon (*Sikyon*), and was a fellow pupil of Pheidias and Murôn under Ageladas. He may have been born about 470 B.C., or earlier, being already a distinguished sculptor about 430 B.C. (There was, however, another far less distinguished sculptor called Polukleitos, of Argos, who lived about a generation later.) Polukleitos, the great or the elder, was chiefly distinguished for his great seated chryselephantine image of Hera at Argos, and his bronze or marble figure, the Doryphoros, called the Canon, so exquisite were considered its proportions.

POLUKRATES, of Samos (Lat. *Polykrates*), in the sixth century B.C., became ruler of the island with the help of his two brothers, with whom he divided the power at first, but afterwards banished one and put the other to death. He raised a formidable fleet, proceeded to conquer islands and cities, attacked Milêtos, and defeated the Lesbians. The alliance between him and Amasis of Egypt is well known from Herodotos, who relates the story of the ring thrown into the sea and recovered in a fish. Amasis was alarmed at his friend's invariable good fortune, which seemed to him such as would tempt the anger of the gods, and he advised him to throw away something that he prized greatly—so as, in fact, to manufacture a misfortune. Polukratês threw into the sea an exquisite and very costly ring. A day or two afterwards a fisherman presented him with an unusually fine fish, and in preparing it for the table the ring was found within it. Upon this Amasis became so alarmed that he broke off the alliance. The Spartans sent an expedition against him in vain, at the time of the power of Cambyses. The Sardin satrap Oroôtês, a bitter enemy, enticed Polukratês to the mainland, and had him crucified in 522. Polukratês was a powerful but cruel and treacherous sovereign. He was very rich, and fortunate in all his enterprises. Living in magnificence and splendour, his court was frequented by poets and artists, of whom he was a generous patron. Anacreon was one of his great favourites.

POLUNEIK'ES (Lat. *Polynices*) was the son of OIDIPOUS and brother of ANTIGONE. See those articles.

POLUPHÊMOS (Lat. *Polyphemus*), in the Greek mythology, was a son of Poseidôn and the nymph Thoôsa, and one of the Cyclops who dwelt in Sicily. He was a cruel monster, of great strength and enormous size, with only one eye (*Kuklops*, circle eye), which was round in shape and placed in the midst of the forehead. When Odusseus landed in Sicily, he and twelve of his companions were entrapped in the cave of Poluphêmos, and six of the number fell victims to the terrible cannibal. The rest escaped through a stratagem of Ulysses, who having made the monster drunk, destroyed his single eye with a flaming firebrand. The love of Poluphêmos for the fair nymph Galatêa (Lat. *Galatea*), who being herself enamoured of the shepherd Akis (Lat. *Acis*), rejected the addresses of

Poluphêmos, and thus brought about the murder of her lover by his gigantic foe, was a favourite story with the ancients. It is the subject of one of Handel's finest works.

POLUXENA (Lat. *Polyxena*), a young daughter of Priam (Priamos) king of Troy, and his queen Hecuba (Hekabê). Her fate was tragic. She was being carried off to Greece as a captive when the shade of Achilles appeared to his former brethren in arms demanding the sacrifice of Poluxena, so that her shade might bear him company in Hades. Neoptolemos, the son of Achilles, solemnly slew her on his father's tomb. The myth is exceedingly curious as showing a great affinity to those savage customs which lead the horse, the dog, and sometimes the wife or slaves of the departed "brave" to be sacrificed for the benefit of his existence in the other world.

POLYANDRY is the name given to the custom by which a woman is married to several men at once. It is less prevalent than communal marriage, and far less than polygamy, but it is found existing among uncivilized or semi-civilized persons in all the great divisions of the world. It is most fully developed in Tibet, where a wife is commonly the property of a whole family of brothers, the eldest of them being the chief husband; and it is found in several districts of Northern India, as well as among the Todas of the Neilgherry Hills, the Coorgs of Mysore, and the Nayars of Malabar. It also exists in Ceylon, in the Aleutian Islands, among the Kayaks, the Zaporozhian Cossacks, in several parts of Africa, and in both North and South America. In former times the custom appears to have been more widespread than at present, and according to the ancient writers it prevailed among the Medians, the Syrians, among the ancient Britons, the Picts, the Getae, and some other races. It is supposed that the custom originated like that of polygamy, from an unequal balance of the sexes, and that like many other customs it continued to be observed long after the special circumstances in which it originated had passed away. See Iatham's "Descriptive Ethnology" (1859), Lubbock's "Origin of Civilization" (1870), and Taylor's "Primitive Culture" (1871).

POLYANTHUS. See PRIMROSE.

POLYBASIC ACIDS. In accordance with their power of saturating bases, acids are divided into *Monobasic* and *Polybasic*. One equivalent of the former class requires only one equivalent of a base to form a normal salt. Of the latter every equivalent requires more than one equivalent of the base. Polybasic acids are again subdivided into *bibasic*, which take up two equivalents of base, and *tribasic*, which require three.

The existence of polybasic acids was first demonstrated by Graham, upon the three modifications of phosphoric acid—the ordinary form, or orthophosphoric acid, being tribasic; the pyrophosphoric, bibasic; and the metaphosphoric, monobasic. Liebig, in 1838, proved that these views ought to be extended to certain acids of organic origin.

For determining the basicity of acids, Gerhardt gives the following characters as approximately decisive:—

1. A *monobasic* acid does not form acid salts by double decomposition. It yields but one ammoniacal salt, one neutral mono-alcoholic ether, and one neutral amide. The volatile organic acids are generally monobasic.

2. *Bibasic* acids may form with a metal *two* salts, one acid and the other neutral; with ammonia, an acid and a neutral salt—an acid amide and a bi-amidated neutral amide. In like manner, with alcohols they form an acid ether and a bi-alcoholic neutral ether.

3. *Tribasic* acids may form with the same metal *three* salts, two of which are acid and the third neutral; with ammonia and the organic bases, three salts and three amides; with the alcohols, three ethers, one of which is neutral and the remaining two acid.

Williamson regards all acids and salts as formed on the type of water, H_2O —a monobasic acid, such as the nitric, being formed by the substitution of a certain radical, such as NO_2 , for one equivalent of hydrogen in one equivalent of water, giving the formula $NO_2H + O$; whilst a bibasic acid is formed by the substitution of one equivalent of a radical for two equivalents of hydrogen in two equivalents of water, e.g. sulphuric acid, $SO_3H_2 + O_2$.

The following are some of the best known polybasic acids:—

BIBASIC ACIDS.

Aspartic.	Malic.	Racemic.
Camphoric.	Mucic.	Saccharic.
Comenic.	Oxalic.	Sebacic.
Fumaric.	Paramucic.	Stearic.
Gullic.	Phthalic.	Suberic.
Itaconic.	Pyrophosphoric.	Succinic.
Knic.	Pyrotartaric.	Tartaric.

No bibasic organic acid has a nucleus consisting wholly of carbon and hydrogen; the nuclei of all these acids contain, in addition, oxygen or nitrogen.

TRIBASIC ACIDS.

Arsenic.	Aconitic.	Meconic.
Orthophosphoric.	Citric.	Tannic.

POLYBIUS (Gr. *Polubios*), son of Lukortas, a distinguished Achaian leader, was born at Megalopolis, in Arcadia, probably about B.C. 204. It is said that he was trained under Philopoinen, the greatest general of the Achaians. In B.C. 181 he was sent by the Achaians on an embassy to Ptolemy of Egypt. After the defeat of Perseus and the destruction of the kingdom of Macedonia, the Romans, not satisfied with having taken cruel vengeance on those Achaian states which they suspected of having secretly supported the cause of Perseus, made out a list of 1000 distinguished Greeks, and sent them to Italy to be tried. Polybius, who was one of the number, attracted the attention of *Æmilius Paulus*, who made him the instructor of his two sons, Fabius and Scipio. Those young men, who became greatly attached to him, obtained permission for Polybius to remain at Rome. He accompanied his friend Scipio in his military expeditions. He probably had already formed the design of writing his great historical work, for which he prepared himself by a diligent study of Roman annals, and travelling in Spain, Gaul, and other countries. When Scipio besieged and destroyed Carthage, B.C. 146, he was again accompanied by Polybius. After the destruction of Carthage, he hastened to the Peloponnesos, where a war with the Romans had broken out. After the Roman commissioners had left Greece, in 145 B.C., Polybius was appointed by them to regulate the affairs of the different states, a duty which he discharged to the full satisfaction of the Greeks. The remaining years of his life he seems to have applied to the revision and completion of his historical works. Lucian says that he lived to the age of eighty-two.

The great historical work of Polybius, in forty books, consisted of two distinct parts, the first of which comprised a period of fifty-three years, from the beginning of the second Punic War to the overthrow of the kingdom of Macedonia. The second part began with the war in Spain against the Celtiberians, and ended with the destruction of Corinth. The main object of Polybius was to show how the Romans within a short period acquired the dominion of a great part of the world; but though Rome was the central figure in his narrative, the plan of the work comprised the history of all those peoples with whom the Romans came into contact. This history is one of those few works which the diligence, the impartiality, and critical judgment of the author have made a lasting monument. It is intended to be practical, a work of political instruc-

tion, and he called it not a history but a *pragmateia*. Polybius did not aim at—or, rather, he studiously avoided—all rhetorical embellishment. The style is far from being agreeable, and it requires some familiarity with it to read him with ease. It may be owing to the work not having been much read that so much of it is lost. Only the first four books of the history are preserved entire; of the remaining books we have only fragments and extracts. The edition of J. Schweighhäuser (Leipzig, 1789-95) contained all the remains of Polybius which were known at that time. The edition of Bekker (Berlin, two vols. 8vo., 1844) includes all that is contained in Schweighhäuser's edition, and also the discoveries of Mai in the Vatican Library.

POLYBOSUS. See CARACABA.

POLYCARP (*Polukarpos*), Bishop of Smyrna, one of the Greek apostolical fathers, has left an imperishable name in the history of the church, in that he forms one of the few links by which the church of apostolic times is connected with that of the second century, but of his personal history very little is known with certainty. The only trustworthy sources of information respecting his life and work are—(1) the notices of Irenæus (*Eirénaios*); (2) a letter of Polycarp to the church at Philippi; (3) a letter of Ignatius to Polycarp; and (4) a letter from the Smyrnan Christians addressed to the church of Pontus, giving a minute account of his martyrdom. In common with most of the writings of primitive times, the genuineness and authenticity of the three letters have been questioned and denied by certain modern critics, but they have been successfully vindicated by Neander, Gieseler, Möhler, Ritschl, Lightfoot, and others. When, however, all the information afforded by these sources is collected, we can glean nothing concerning the birth, family, education, or early life of Polycarp, but from other grounds it may be shown to be in the highest degree probable that he was a native of Asia Minor, and that he was born there before the year 69 of a family which had been converted from heathenism. It is certain that he was a disciple of the apostle John from the testimony of Irenæus in his letter to Florinus, which has been preserved by Eusebius, "I could even now point out the place where the blessed Polycarp sat and spoke, and describe his going out and coming in, his manner of life, his personal appearance, the addresses he delivered to the multitude, how he spoke of his intercourse with John, and with the others who had seen the Lord, and how he recalled their words," &c. In after-life Polycarp was appointed Bishop of Smyrna, where he laboured for many years, gaining great influence among the Christians by his piety and zeal for the cause. A strong supporter of the doctrine of the apostles, he was greatly troubled during the later period of his life by the rise of the Marcionite and Valentinian sects, and it is reported by Irenæus that when MARCION accosted him with the words, "Acknowledge us," he replied, "I acknowledge thee as the first-born of Satan." Polycarp was Bishop of Smyrna when Ignatius of Antioch passed through that city on his way to Rome (107-116 A.D.), and the two friends, both pupils of St. John, had much friendly intercourse. Another interesting incident of his career was a journey which he made to Rome in 154, when he was very aged, to visit Aulicetus, the bishop of that city. The two bishops soon came to an agreement respecting certain points that had been in dispute between their respective churches, while concerning others upon which they could not agree they adhered to their own views without any unfriendliness. Within a few months of his return to Smyrna, on the occasion of the festive games, the fury of the heathen multitude and of the Jews was roused against the Christians, and Polycarp, as the leader of the latter, was arrested and brought before the Roman pro-consul. The latter, moved by the venerable appearance of the prisoner, endeavoured to save him, and

offered to set him at liberty if he would "revile Christ." "Eighty and six years," replied Polycarp, "have I served him, and he never did me wrong, and how can I now blaspheme my King that saved me?" In the end he was condemned to be burned alive, and being delivered to the populace, "the crowd forthwith collected wood and straw from the shops and baths, and the Jews, as usual, most freely offered their services for this purpose." He suffered with the utmost constancy, and by his death he saved his congregation from further persecution. The year of his death is given as 166 A.D. by Eusebios in his chronicle, and this statement remained unquestioned until 1867, when Waddington published some elaborate arguments based upon unquestioned data in support of the year 155. His reasonings have been examined and accepted by many eminent scholars, though others adhere to the date given by Eusebios. Of the single epistle of Polycarp, valuable for its numerous quotations from the New Testament, there are English versions by Cave, Wake, and Clementson. See also "The Apostolic Fathers," by Bishop Lightfoot (London, 1885).

POLYDEUCES. See POLUDEUKES.

POLYG'ALA is a genus of plants belonging to the order POLYGALÆÆ. The species are very numerous, natives of the temperate and warmer regions of the world. They are herbs or shrubs with entire leaves and irregular flowers arranged in racemes. The sepals are five, persistent, the two inner being large, winged, and petaloid; the corolla is gamopetalous, composed of three petals, the anterior of which, the keel, is large and crested; two other minute scale-like petals are sometimes present; the fruit is a two-celled capsule. The Common Milkwort (*Polygala vulgaris*) is common in Britain, especially on a chalky or limestone soil. The flowers, collected in terminal racemes, are small but handsome; their colour varies, being sometimes bright blue, sometimes pink or white. Several subtropical species are cultivated in this country as ornamental plants. Many of the species contain a bitter principle, which gives them powerful medicinal properties. The root of *Polygala senega* (the Virginian snake-root), a native of several parts of the United States, is used in medicine, especially in cases of chronic bronchitis. It possesses very manifest stimulating and tonic powers, especially over all secreting organs, whether the skin, mucous membranes, or glands. It is used by the American Indians as a cure for snake-bites. Many of the species, and among them *Polygala vulgaris*, have powerful emetic properties.

POLYGALÆÆ is an order of plants belonging to the group THALAMIFLORÆ. They are shrubs or herbs, with leaves simple, entire, exstipulate, and alternate, rarely opposite. The flowers are irregular, sometimes solitary. The sepals are five, free, imbricate, the two inner largest, often winged and petaloid; the petals are three or five, hypogynous; the two lateral either free or united with the anterior petal or "keel"; the stamens are usually eight and monadelphous, with the anthers one-celled, opening by pores; the ovary is free, usually two-celled, with solitary pendulous ovules. The fruit is usually a capsule, sometimes a drupe. About 400 species are known, dispersed over the temperate and warmer parts of the world. They contain a bitter principle, which gives them tonic and astringent properties. About half the species belong to the typical genus *POLYGALA*.

POLYG'AMOUS, in Botany, is a term applied to those plants which have male and hermaphrodite, or female and hermaphrodite, or female, male, and hermaphrodite flowers on the same or different individuals.

POLYG'AMY is the name of the custom according to which a man may have more than one lawful wife at a time. It has existed in Asia from time immemorial, and Mohammedanism adopted and confirmed it.

Neither Greek nor Roman usage allowed a man to have more than one wife. The barbarous nations, on the contrary, that is to say, those who were not Greeks or Romans, practised polygamy, with the exception of the Germans, "who alone," says Tacitus, "among all the barbarians, are content with a single wife" ("German," 17). In some districts of Media a man was considered disgraced if he had less than seven wives.

In the Scriptures we find many instances of polygamy recorded; but in the time of Christ no indication appears of its being common among the Jews. Divorce, however, was frequent, and our Saviour (Mat. xix. 9) reprobates the custom. St. Paul speaks always of marriage in terms implying the union of one man with one woman. In Christian countries polygamy has been long since universally forbidden, both by the church and by the civil law. In England it is a punishable offence. See BIGAMY.

Polygamy is one of the leading tenets of Mormonism, and is carried by its professors to a shameless extent.

The Koran allows a man to have four legitimate wives; but it is only the rich who avail themselves of this permission. The Arabs are generally content with one wife.

POLYGLOTS (Gr. *poluglōtta*, from *polus*, many, and *glōtta*, a tongue), books in several languages. The application of the word is restricted to the Bible, which, being a collection of books written by various persons, at various times, and on various subjects, is called Biblia ("books"), and a Polyglot Bible is therefore called Biblia Polyglotta.

The idea of a Polyglot Bible seems to have been first conceived in the third century by Origen, who spent many years in forming the Old Testament into such a work. This is commonly called Biblia Hexapla, the Bible in six columns. The six columns consisted of—(1) the Hebrew text; (2) the Hebrew in Greek characters; (3) the Greek version of Aquila; (4) the Greek version of Symmachus; (5) the Septuagint; (6) the Greek version of Theodotion. These six columns went through the work; but some portions were in eight columns and others in nine, and with reference to these portions it is called Octapla and Enneapla. Considered apart from the Hebrew, and the Hebrew in Greek characters, it is called Tetrapla, the Bible in four columns. Though two languages only were used in the formation of this work, it might not improperly be called a polyglot. Except in the Septuagint, only a few fragments of Origen's performance have come down to us. These were published by Montfaucon, in two vols. folio (Paris, 1714), under the title "Hoxaplorum Originis quæ supersunt."

Among the moderns, Aldus Manutius first planned a polyglot in Hebrew, Greek, and Latin; but he never printed more than one sheet. Since that time various polyglots have been published, of which the principal are the following:—(1) The Complutensian Polyglot. This was printed at Complutum, the Latin name of Alcalá de Henares, in Spain. It was begun in 1502, under the careful superintendence of Cardinal Ximenes, and finished in 1517, but was not published until 1522, in six vols. folio. (2) The Antwerp Polyglot, printed by Christopher Plantin at Antwerp (1569-72), in eight vols. folio. The editor was Arias Montanus, who had about sixty assistants. The whole of the Complutensian Polyglot is comprised in the Antwerp Polyglot, besides other matter. (3) The Parisian Polyglot, printed at Paris by Antony Vitré (1628-45), in ten vols. large folio, and under the editorship of Guy Michel le Jay. It contains all that the two other polyglots contain, and also an Arabic version of the Old and New Testament, a Syriac version of the former, and the Samaritan Pentateuch. (4) The London Polyglot. This was edited by the learned Brian Walton, afterwards bishop of Chester. It is in six vols. large folio. It was published by subscription, and the volumes came out in the following order—the first volume in September, 1654; the second

in July, 1655; the third in July, 1656; and the last three in 1657. Some portions of this polyglot are printed in seven languages, all open at one view. No one book is given in nine languages; but nine languages are used in the course of the work, namely, Hebrew, Chaldee, Samaritan, Syriac, Arabic, Persian, Ethiopic, Greek, and Latin. A vast body of introductory matter is included in the first volume, and the sixth is made up of various readings, critical remarks, &c. Brian Walton was assisted by a constellation of Oriental and general scholars, such as perhaps has appeared together at no other period during the whole history of our country. One of these was Dr. Edmund Castell, who published his "Lexicon Heptaglotton" in 1690, two vols. folio. This is a lexicon of the seven Oriental languages occurring in Walton's Polyglot, and it has grammars of all these languages prefixed. Walton's work is by no means equal in appearance to the three preceding polyglots, but in point of solid usefulness it is far beyond any one of them. (5) Bagster's Polyglot. This work was published by the enterprising bookseller whose name it bears, in one vol. folio (London, 1831). The Old Testament is in eight languages, and the New Testament in nine. Eight languages are exhibited at once upon opening the book. These are Hebrew, Greek, English, Latin, German, Italian, French, Spanish, and Syriac, the New Testament being given in the last language as an appendix. To these are added the Samaritan Pentateuch in Hebrew characters; the notes and readings of the Masorites; the chief variations of the Vatican text of the Septuagint (which is followed in this polyglot), and of the Alexandrine as given by Grabe, Oxford; and of the Greek Testament the whole of the selected various readings given by Griesbach in his own edition of 1805. The types are small, but clear and elegant, and the paper is of excellent quality.

POLYGON OF FORCES (Gr. *polus*, many; *gónos*, angle), a construction in physics invented by Leibnitz, whereby one may discover the resultant of many forces acting on one point. The imaginary polygon is constructed, having its sides parallel to the direction of the various forces, and of lengths proportionate to the strength of these forces; it will have one side deficient, and the line necessary to form this side will be in direction and length the representative of the direction and strength of the resultant force arising out of the combination of all the other forces, acting on the given point. Whence it follows that if any number of forces acting on a point are in equilibrium, lines parallel and proportional to them will construct a complete polygon; and conversely, a number of forces acting on a point, each one parallel and proportional to one of the sides of a polygon, will be in equilibrium on that point.

POLYGONACEÆ is an order of plants belonging to the group **MONOCHLAMYDÆÆ**. The species are herbs and shrubs, with alternate leaves, exstipulate or with closely sheathing stipules. The flowers are hermaphrodite or unisexual, and regular. The perianth is inferior, sometimes coloured, of from four to six segments; the stamens are six to nine, inserted into the bottom of the perianth; the ovary is free and one-celled, formed of two to four carpels, with two or three styles; the ovule is solitary, orthotropous. The fruit is a nut, usually triangular, and covered with the persistent perianth, which is sometimes fleshy. About 600 species are known from all parts of the world, especially the northern temperate regions. Most of them have astringent properties, and several are used in medicine as purgatives, &c. The genus **POLYGONUM** contains several species employed medicinally. **RHUBARB** (*Rheum*), a valuable purgative and stomachic, belongs to this family, which includes also the Sorrels and Dock (Rumex). Buckwheat (*Fagopyrum esculentum*), a native of Northern Asia, is cultivated in Europe as a substitute for cereals; it grows in the poorest soil, and requires but little care in cultivation.

POLYGO'NUM is a genus of plants belonging to the order **POLYGONACEÆ**. The species are numerous, consisting of herbs, with alternate stipulate leaves, and flowers usually collected in spikes or racemes. The perianth is five-cleft, coloured, and persistent, usually increasing in size after flowering and investing the fruit. *Polygonum bistorta* (the Bistort or snake-weed), a European species naturalized in England, is one of the most powerful vegetable astringents; its root contains tannin and gallic acid in abundance. It is not much used in medicine at the present day, but in Cumberland the green tops are eaten as a vegetable. Several of the species are natives of Great Britain, as Knot Grass (*Polygonum aviculare*), a weed with trailing stems, small lanceolate leaves, and very small flowers, which grows abundantly; The Spotted Persicaria (*Polygonum persicaria*) flourishes in waste places and on dunghills. *Polygonum amphibium*, found in ponds, ditches, and wet places, is a fine showy plant, but one of the most difficult to eradicate from lands recovered from rivers, or drained lakes and marshes. The subaquatic stems root at every joint, and extend to a surprising length, rising through the soil. *Polygonum hydropiper* (the water-pepper) is a hot acrid plant, and is reputed to be a powerful diuretic, but it loses its activity by drying, and therefore requires to be used in a fresh state. It dyes wool of a yellow colour. The Climbing Buckwheat (*Polygonum Convolvulus*) is a twining weed, often very troublesome among grain crops. The Dyer's Buckwheat of China (*Polygonum tinctorium*) yields a blue dye little inferior to indigo.

POLYHYM'NIA (Lat.) or **POLUM'NIA** (Gr.), that is, the Many-hymned One, one of the Nine Muses, inventress of the lyre, and inspirer of lyric poetry. She is depicted as sitting in a thoughtful attitude.

POLYMER'IC, a term applied in chemistry to bodies which have the same percentage composition, but differ in molecular weight. The hydrocarbons of the series, C_nH_{2n} , present the best example of polymerism; all of these are multiples of the lowest body in the series, methane (CH_4). These compounds exhibit regular gradations of boiling point, vapour density, and other physical characteristics, from the lowest to the highest, although all have the same percentage composition.

POLYNEMUS is a genus of fishes belonging to the order **ACANTHOPTERYGII**, and forming the family **Poly-nemidæ**. This genus is remarkable for having several long filaments beneath the pectoral fin, of which they are detached rays. They vary in number, according to the species, from three to fourteen, and in some are twice as long as the body. They can be moved independently of the pectoral fin, and function as organs of touch. The ventral fins are thoracic, with one spine and five rays. The teeth are minute and dense as the pile on velvet, or recurved like the teeth in a carding machine; they are found on both jaws, as well as on the vomer and palate. The general form of the body somewhat resembles that of the perch. The muzzle projects over the mouth; the eyes are rather large, and placed very forward; the two dorsal fins are short and widely separated, and the caudal fin is large, and more or less forked. The scales are feebly ciliated and extend on the fins. The species are rather numerous, inhabiting the muddy bottoms of the mouths of rivers in the tropics; they are also found along the coasts, and some even enter fresh water. The Mango Fish (*Polynemus paradiseus*) inhabits the Bay of Bengal, and it ascends the Ganges, Hoogly, and other rivers. It is very highly esteemed for food by the Anglo-Indians, especially when salted and prepared in a peculiar manner. It is a small fish, about 8 or 9 inches long, resembling in colour a ripe mango—whence the name. A much larger species, *Polynemus indicus*, common in the Malay Archipelago, has a large thick-skinned silvery air-bladder, with

about thirty or thirty-six appendages. This, when dried and prepared, is exported from Singapore as "fish-maw," and yields a good quality of isinglass.

POLYNESIA, a geographical term signifying "many islands" (Gr. *polus* and *nesos*), under which the continent of Australia and all the islands in the Eastern seas and in the Pacific from Sumatra to the western coast of America, between 85° N. and 56° S. lat., and between 94° E. and 105° W. lon., are sometimes included. To this immense space on the earth's surface modern geographers apply the name of *Oceania*, which they divide into Malasia or Western Oceania, comprehending Sumatra and other Indian islands north of Australia as far as the Philippines inclusive; Central Oceania, which comprises Australia, New Guinea, New Zealand, and the islands in their immediate vicinity; and Polynesia or Eastern Oceania, which comprehends all the other islands in the Pacific from the south of Japan and the east of the Philippines to the island of Sala, the most eastern of the Polynesian Islands. In this latter acceptance Polynesia is now generally used.

It may, however, be considered as divided by the equator into two sections:—*North of the Equator*, comprehending the Caroline Islands, Gilbert's Archipelago, the Galapagos, the Ladrone or Marian Islands, the Pelew Islands, the Raduck or Ralik chains or groups, and the Sandwich Islands. *South of the Equator*, the Dangerous Archipelago, Easter Island, Harvey or Cook's Islands, the Ellice group, the Fiji group, the Friendly Islands, Marquesas Islands, Navigator Islands, Pitcairn Island, Society Islands, and Union Archipelago. These occupy a broad belt from about 20° N. lat. to 30° S. lat., and are partly volcanic, partly coralline. The volcanic generally attain a considerable elevation above the sea-level, as in Tahiti and Owhyhee, the former rising to a height of 10,000 feet, the latter to that of 15,000 or 16,000 feet. The Friendly, Marquesas, Navigator, and Sandwich Islands are all volcanic. Most of the other groups are of coralline formation.

It may be added that the soil of the volcanic "ocean-gems" is generally rich and prolific, yielding the bread-fruit, yam, guava, cocoa-nut, plantain, cotton, sugar-cane, and numerous fruits and plants introduced by European navigators. The indigenous quadrupeds are dogs, pigs, and rats, but the sheep, ox, and goat have been successfully acclimatized. The scenery of the islands is truly Arcadian in its rich and gentle beauty, and the mariners who first visited their shores conceived themselves to have discovered the fabulous Islands of the Blest. An alternation of land and sea breezes renders their climate delightfully temperate, and the waters around teem with fish and crustacea.

The inhabitants belong to two races, which have, however, many affinities. Those who people the western isles, towards Australia and South-eastern Asia, are generally of the Papuan negro race; while the inhabitants of the far-out isles, as Tahiti, &c., are less dark and negro-like, taller and better made, and present many analogies with the Malays and American Indians, yet differ so widely as to be considered an intermediate variety.

Polynesian Languages.—These form a very striking group, with strongly-marked common characteristics. The group is often called, from its most important member, the Malay-Polynesian group. The present inhabitants of Malacca are insular in origin, and only obtained their footing on the mainland since the twelfth century. The languages are therefore in origin all Polynesian, and their home is the islands lying off the south-east of Asia (except Borneo and New Guinea) and away through the isolated spots of land that gem the Pacific, extending north to Formosa, east to Easter Island, south to New Zealand, west to Madagascar. Some, as the Malays, use the Arabic alphabet; others, as the Philippines, use Indian alphabets. (Part of the Philippines are Papuan in speech.) The chief divisions are—the Malayan (with Philippine and Ladrone groups), the Poly-

nesian (with New Zealand and Madagascar), and the Melanesian, including Fiji and other archipelagoes north-east of Australia. The latter are much divided, but the two former are closely related.

Grammatical relations are only indicated by pronouns and particles. (In the Malay group these have a tendency to become affixes.) Gender, number, person, case, mood, and tense are all wanting; noun, adjective, and verb are all indistinguishable. The pronouns alone are honoured with an exception: they possess number; and the first person has a double plural, a *we* inclusive of the person addressed ("you and I") and a *we* exclusive of the person addressed ("we, not you"). In short, these curious tongues are more simple than any others in the world as to phonetic structure. None of them have more than ten consonants, except where foreign influence has been felt; few of them have more than seven. No syllable closes with a consonant, and a beautifully liquid effect is gained in this way in some of the prettier of the Pacific tongues.

POLYOMMATUS is a large genus of BUTTERFLIES, containing the species known to collectors as "Blues." The scientific name ("many-eyed") refers to the numerous black spots inclosed in white rings with which the under surface of the wings of most are adorned. The Blues (so called from the prevailing colour of the male) are very beautiful insects, and many species are British. The Common Blue (*Polyommatus icarus*) is very abundant in meadows, open heaths, and downs in England. In the male the upper surface of the wings is lilac-blue, with white fringes, and in the female blue more or less mixed with brown, with a border of orange-red spots. Most of the English species are commonest on the chalky soil of the southern counties; the most beautiful of these are the Adonis Blue (*Polyommatus adonis*), in which the male is a brilliant sky-blue, with black fringes, and the Chalk-hill Blue (*Polyommatus corydon*), in which the male has pale silvery blue wings, bordered with black. The Azure Blue (*Polyommatus argiolus*), which extends to the Lake district, differs from the other species in frequenting woods and hedges, especially where holly and ivy abound, the caterpillar feeding upon these plants. The male resembles in colour the common blue, and the female is also blue, and not brown as in the two preceding species. Several other species are found in Britain, of which one, the Bedford Blue (*Polyommatus albus*), the male of which has dark brown wings, is the smallest of British butterflies. The caterpillars of these butterflies feed generally upon vetches and other papilionaceous plants, and exude a secretion from their bodies of which ants are very fond.

POLYPE (Gr. *polus*, many; *pous*, foot), a word originally applied to the OCTOPUS by Aristotle, was used by Cuvier as the general name of the animals belonging to the classes Hydrozoa, Actinozoa, and Polyzoa. The last class is now widely separated from the two preceding, which form, together with the Sponges (Porifera), the sub-kingdom COELENTERATA. In many works the term is used to denote the soft-bodied individual in the variously formed colonies which occur largely in all these classes. The term polype is now merely descriptive, and is often restricted to the individual form in the Hydrozoa resembling the common fresh-water Hydra, as distinguished from the medusa form. See HYDROZOA.

POLYPETALÆ is a subclass of DICOTYLEDONS, containing plants which have the petals of the corolla distinct, or *polypetalous*, rarely absent. It contains three subdivisions, THALAMIFLOREÆ, DISCIFORMÆ, and CALYCIFFLOREÆ. For the names of the orders which belong to the Polypetalæ see BOTANY.

POLYPHONIC, in music, is used of composition in two or more parts, each of which has its own peculiar melody, supporting one another, and contributing equally to the general effect.

POLYPO'DIUM is a large genus of FERNS belonging to the group Polypodiaceæ, distinguished by having its spore-cases collected in circular sori, which have no indusium. The species are numerous, and found in nearly every part of the world. The Common Polypody (*Polypodium vulgaria*) is one of the commonest of British ferns, growing in sheltered places, on the trunks of old trees, walls, &c. It has a thick, woody, creeping root-stock. The fronds, which rise from half-a-foot to two feet in height, are deeply pinnatifid, the segments being linear-oblong. The sori are rather large, and of a golden-yellow colour, and are collected on the upper part of the frond. This species was formerly a domestic remedy for colds, &c. The Beech Fern (*Polypodium Phegopteris*) is another British species, found in England chiefly in the west and north, inhabiting damp places. The Oak Fern (*Polypodium Dryopteris*) is found in dry woods in Britain, but is very rare in Ireland. *Polypodium alpestre* is an alpine species, occurring in Britain only in the Highlands of Scotland.

POLYPORUS is a large genus of fungi, belonging to the group HYMENOMYCETES, distinguished by the spore-bearing surface (*hymenium*) clothing the inner surface of tubes, in which character it agrees with *BOLETUS*. The species are very numerous, many being European. A few are edible, as the Italian *Polyporus tuberosus*, and others furnish articles of commerce. The best AMAIDOU of commerce is obtained in Germany from *Polyporus fomentarius*. The DRY ROT of the oak is due to *Polyporus hybridus*.

POLYPTERUS is a genus of fishes belonging to the order GANOIDÆ and family Polypteridæ. Only one species is known, *Polypterus bichir*, inhabiting the Nile and the rivers of the west coast of tropical Africa. The Polypterus is very interesting, as being one of the few living representatives of a type common in Palæozoic times. It attains a length of 4 feet, and has an elongated cylindrical body protected by hard lozenge-shaped ganoid scales. The pectoral and ventral fins are of an ancient type, consisting of an axial skeleton with the rays forming a fringe on each side. The dorsal fin is broken up into from eight to eighteen finlets, each consisting of a flattened spine to which several soft rays are attached. The dorsal fin runs into the caudal fin, which surrounds the extremity of the body, and is symmetrical or "diphycercal" in shape, as in the Dipnoi and some extinct ganoids. The anal fin is placed close to the caudal, just behind the vent. The head is defended by bony plates. The mouth is wide, provided with broad bands of rasp-like teeth in the jaws and on the vomer and palatine bones; in addition there is an outer series of large-pointed teeth in the jaws. Spiracles or openings leading into the pharynx, as in the sturgeon, are present, one on each side of the head, and are covered by a bony plate. Three and a half gills form the respiratory apparatus, protected by a bony operculum. The air-bladder is double, communicating by a duct with the œsophagus. The Polypterus inhabits the muddy bottoms of rivers, on which it crawls about by means of its fins. It swims with great rapidity. A very closely allied form, *Calamoichthys calabaricus*, inhabits Old Calabar, and is distinguished from Polypterus by its smaller size, more elongated form, and the absence of ventral fins.

POLYPUS, in medicine, is the name given to any simple morbid growth springing from a mucous surface, to which it is attached by a more or less narrow pedicle. Polypi occur most frequently near the orifices of external communication of the mucous canals, as in the uterus, the fauces, the larynx, and the nose. Polypi of the uterus are of three kinds—*cystic*, *mucous* or *soft*, and *hard* or *fibrous*. The latter are the most common, and they sometimes assume very large dimensions. The polypi of the nose are of two varieties—the *mucous* and the *fibrous*, the latter frequently

involving the structures at the back of the pharynx. The only satisfactory mode of treatment consists in their removal, wherever it is possible, by surgical operation, which may be effected by avulsion, the stroke of a sharp instrument, or it may be cut through slowly or rapidly by some form of écraseur or ligature. The term *malignant polypi* is sometimes used to designate growths of a cancerous nature from the mucous membrane, the name having been given rather from the growths having the same situation as the preceding than from their similarity of form. When these are removed it is necessary to take away also a wide margin of healthy tissue as well, in order to prevent their re-forming.

POLYTECH'NIC (Gr. *polus*, many, and *techné*, art), a term now applied to any institution or establishment designed to promote the cultivation of the arts and sciences, but especially famous in connection with the Polytechnic School (*École Polytechnique*) of Paris, founded in 1794–95, for the education of youths preparatory to their entering the corps of engineers or other branches of the public service. It was warmly patronized by the Emperor Napoleon I., who organized it on a military system, and converted it into a training institution for the army. Its students were ardent Bonapartists, and the Bourbon government in 1816 thought it advisable to dissolve it, and reconstruct it under a different code of regulations. The Emperor Napoleon III. introduced further modifications in 1852. It now admits pupils between the ages of sixteen and twenty, or, if in the army, sixteen and twenty-five, who have successfully passed through a preliminary competitive examination. The entrance charge is 1000 francs (£10) per annum, and the course of instruction, which last two years only, is terminated by an examination. The successful candidates then select what branch of the public service they prefer, and are arranged according to their order of merit. The number of students is about 350, from whose ranks have proceeded nearly all the mathematicians and philosophers of France who have risen into repute during the last half century.

POL'YTHEISM (Gr. *polus*, many; *theos*, a god), the doctrine or worship of a plurality of gods. This form of the word is not found in Greek writers.

Polytheism differs from idolatry in this respect—the former refers to a plurality of gods, without including necessarily the notion of forms, real or imaginary; the latter refers either to one god only, under some one visible form, or to any number of gods, under as many visible forms. Formerly polytheism was supposed to represent a degradation of a primitive monotheism, but it is now most generally regarded as representing a stage of development of the human mind intermediate between fetichism or nature worship and the conception of one all-supreme deity, which belongs to a somewhat advanced stage of progress. The notion of the existence of many deities can be traced back to the most remote periods, and it still represents the belief of the great majority of the human race. In some countries, such as ancient Egypt or modern India, it assumes such monstrous shapes as to be almost incomprehensible to the Western mind, but in others it assumes a form not greatly different in its essentials from some forms of Christianity. The Greeks and Romans, at least in the popular creed, were polytheists, but both nations respectively acknowledged a supreme god under the name of Zeus and Jupiter. Among both peoples also we find that the character of the chief deity, as portrayed in the current mythology, prevented him from being accepted as the highest power in the universe, and behind and above him was placed a dim mysterious power termed Fate, to which he, like man, was compelled to bow. The necessity for some minor deities to interpose between man and the all-supreme deity has been felt in connection with most of the great religious systems of the world; and the influence of this feeling

may be clearly traced in the history of the doctrines of the three great monotheistic religions, Judaism, Christianity, and Mohammedanism. See also the articles under GOD, ANGELS, and DEVIL.

POLYZO'A or **BRYOZO'A** is a group of animals often classed with Brachiopoda, to form a class, Molluscoidea. The affinities of the Polyzoa have been recently pronounced to be rather with the Vermes than with the Mollusca, and until further knowledge is gained on the subject they are best considered as an isolated group. The Polyzoa were known first to naturalists from the horny or calcareous skeletons of the colonies of which they are composed, and it was only in 1830 that the soft animal forms were discovered. With one exception throughout this group, large colonies, often highly differentiated, like those of the Hydrozoa, are built up. These colonies inhabit both salt and fresh waters, but chiefly the former, being found in the sea between tide-marks and a depth of about 200 fathoms, and in less abundance at greater depths. They exhibit various forms, some being erect tree-like growths, others, the sea-mats of our coasts, forming broad mat-like growths, while others resemble corals or sponges. Most of them are attached to foreign bodies, such as rocks, stones, shells, and even animals, such as crabs, annelids, &c. One remarkable colony, *Cristatella*, found in fresh waters, is locomotive, creeping slowly on the muscular ventral surface. The animals or polypides composing these colonies are very minute. Each lives freely within a cell, usually of a horny character, formed by the cuticle. The annexed cut represents two isolated polypides, highly magnified, one retracted within its cell. the other

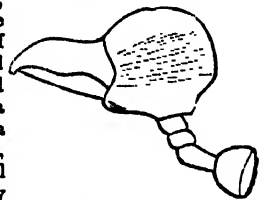


with its tentacles expanded. At the anterior end or spout of the cell the cuticle is very delicate, allowing portions of the body of the animal to be expanded and retracted at pleasure. The retraction is effected by five large muscles which lie in the body cavity, and the orifice of the cell is in most cases closed by a circlet of bristles, or by a movable operculum. In the expanded condition the body of the polypide is terminated by a circlet of tentacles, which are beset with numerous cilia, the beating of which causes a whirlpool in the water, sweeping the animalcules which form its food into the animal's mouth. These tentacles, which are hollow and flexible, have other important functions to fill, for they serve as gills, and probably also as tactile organs. They spring from a platform or *lophophore* which surrounds the mouth, and is either circular or horseshoe-shaped. In addition, there is in some forms a little lobe (epistome) overhanging the mouth, forming a protection to the entrance of the alimentary canal. The latter organ lies loosely in the body-cavity, attached by one

or two mesenteries (*funiculi*) to the body-wall. It forms a U-shaped loop, the anus lying near the mouth, either within the circlet of tentacles or more usually just outside it. The intermediate portion forms a capacious digestive stomach, between which and the oesophagus is placed in some forms a muscular gizzard. The body-cavity is usually large, and contains a corpusculated fluid, which flows into the tentacles, and is common to all the polypides, either directly or through perforated septa, called communication-plates. The interchange of this perivisceral fluid, which has both nutritive and respiratory functions, combining those of the lymph and blood of higher animals, is the sole connection which exists between the individual members of the colony. No heart nor bloodvessels are found. The nervous system consists of a single nerve-ganglion placed between the mouth and the anus, and giving off nerve-fibres to the tentacles and the other parts round the mouth. Excretory organs are absent, except in a few forms (*Loxosoma*), where there is a pair of minute ciliated canals homologous with the embryonic kidneys of some worms. The reproductive system is very varied. Usually both sexes are present in the same animal, the generative products developing on the funiculus. Sometimes the eggs are fertilized, and undergo their first development within the body-cavity, but in other cases they are developed within peculiar structures, which are in fact modified polypides. The free ciliated polyzooan larva takes various shapes in the different sections of the group, but in all the genera except one (*Loxosoma*) it fixes itself and multiplies by budding, and so forms a large colony to which additions are constantly being made. In one group which is confined to fresh water (*Phylactolamnatæ*) a peculiar process of internal budding takes place. These internal buds or *statoblasts* are developed on the funiculus, and are inclosed in two horny plates, which open after a period and liberate a polypide already matured.

In some forms all the members of the colony are alike, but in others (*Gymnolamnatæ*) a remarkable differentiation takes place, some of the polypides being specialized to perform certain functions for the good of the community.

The modified polypides, known as *aricularia*, are situated in various parts of the exterior of the cell, and in their most perfect stalked form (see cut) present a remarkable resemblance to a bird's beak. The jaws, which are worked by special muscles, are continually snapping together, and seize



and retain organisms, such as worms, which come within their reach. Their object is not to secure food, for they have not the power of conveying the captive to the mouth of the normal polypide. It has been conjectured that the vigorous snapping of the jaws scares away intruders, or they may have a cleansing function like the pedicellariæ of the Echinoderms. The *vibracula* are even further modified polypides, consisting of a long slender bristle, situated on a prominence in a hollow cup, which contains the muscles by which it is worked. These bristles are in almost constant motion, sweeping over the surface to which they are attached; their function is probably tactile, though some regard them as defensive and cleansing organs. The roots and stems of some of these complex colonies are also to be regarded as forms of modified polypides.

The Polyzoa are divided into two subclasses, characterized by the position of the anus—*Ectoprocta*, in which it is outside the area of the lophophore; and *Endoprocta*, in which it is situated inside it. The subclass *Ectoprocta* contains the majority of the species, and is divided into

two orders. The first, *Phylactosmata*, which is confined to fresh waters, is distinguished by a horseshoe-shaped lophophore and the presence of an epistome, and the production of statoblasts in addition to the ordinary methods of reproduction. *Cristatolla*, the only free moving polyzoon colony, belongs to this order. The order *Gymnosmata*, which contains a large number of recent and fossil species, is devoid of an epistome, and has a circular lophophore. All the genera except one (*Paludicella*) are marine. It is divided into subordinate groups, according as the orifices of the cells are protected by an operculum, or by bristles, or are devoid of processes. In the subclass *Endoprocta* the whole circle of tentacles cannot be retracted, as in the *Ectoprocta*, but the individual tentacles can be partially rolled up so as to overhang the mouth. The animals are seated on long contractile stalks, which are united to form a colony by a creeping stem or stolon. Only three genera are known, one of which, *Loxosoma*, is solitary and attached to marine worms, &c.

Two very aberrant genera, *Rhabdopleura* and *Cephalodiscus*, are usually placed in a third subclass, *Pterobranchiata*. In the former the lophophore is drawn out into two arms, upon each of which are two rows of ciliated tentacles; in the latter, which was discovered in the *Challenger* expedition, there are twelve arms, each bearing two rows of tentacles. The epistome in these forms is very large, serves as a foot, and secretes by glands on its surface the tubes in which the animals live. *Rhabdopleura* produces large tree-like colonies, but in *Cephalodiscus* the buds do not remain in organic connection with the parent, but are merely inclosed in a common jelly-like envelope.

The species of *Polyzoa* are very numerous, and worldwide in their distribution. A large number, of which the sea-mats (*Flustra*) are the commonest, are found on British coasts; and the fresh-water forms are also abundant in Britain. In former ages this class was well represented, commencing in the Silurian rocks, and attaining their maximum in the Secondary epoch.

POMADE and **POMATUM** are names derived from the French, and were originally applied to a fragrant ointment made by boiling over-ripe apples in lard, but now given generally to all perfumed fats used for dressing the hair. The fatty basis of the majority of these preparations is derived from such materials as lard, beef or mutton suet, beef marrow, veal fat, and more rarely bears' fat, either singly or in mixtures of two or more of them. It is of great importance that the fat should be fresh, and in as pure a state as possible, and the crude material, after being well pounded and beaten up in a mortar, is generally melted by perfumers by means of the water bath and carefully strained and filtered. The perfume is added when the fat is in a liquid state, and then, if it is desired that the pomade should be opaque and white, it is assiduously beaten up with a glass or wooden knife or spatula until it solidifies. When it is intended that the preparation should present a transparent or crystalline appearance the fat is allowed to cool very slowly and without being disturbed. The plain pomatum of the shops is generally made by adding a little essence of lemon or bergamot to a mixture of two parts of lard to one of suet prepared as indicated, a reddish tinge being sometimes imparted by the addition of alkanet root or carmine. Beef marrow and suet are also frequently combined for the preparation of pomade, and various oils, such as almond, castor, olive, and palm, with spermaceti and white wax, are used by perfumers in connection with an endless variety of perfumes in the manufacture of their own "special" applications for the hair. Those which are sold to promote the growth of whiskers and to prevent baldness generally depend for their active ingredient upon cantharides.

POMBAL, MARQUIS DE (SEBASTIAN JOSEPH DE CARVALHO E MELLO), the greatest statesman that Portugal has produced, and one of the foremost men of his

time, was born 18th May, 1699, at Sowra, a village in the territory of Coimbra, of an old and noble family. He was educated at the University of Coimbra, and afterwards studied for the bar, but soon abandoned law for the army, and after giving the latter a short trial retired into private life. Subsequently he married a rich widow, Teresa da Moronha Almada, and repaired to court, but it was not until 1739 that he obtained any public appointment, being in that year sent to London as secretary of legation. In 1745 he was recalled and sent as ambassador to Vienna. Here (his first wife being dead) he married the Countess Daun, through whose influence with her countrywoman, the dowager queen and mother of Joseph I., he was recalled from Vienna to become minister of foreign affairs. A strong-willed, clear-headed man, Pombal soon had the weak-minded Joseph completely under control, and thus was able to give free play to his genius for administration, which was of the highest order. Previous to his advent the power of the state had been monopolized by the intriguing Jesuits and grasping nobles who surrounded the throne, and between them they had almost ruined the country. Pombal began his work by checking the Inquisition and restraining the power of the clergy, and then he recovered for the crown the corn lands which had been unjustly alienated. Then followed a reorganization of the army, the navy, the police, and the finances, while he gave to the University of Coimbra a new system of studies, and encouraged agriculture, printing, and manufactures. He freed the Indians of the Brazils from slavery, and introduced into these important colonies the cultivation of coffee, sugar, cotton, rice, indigo, and cocoa, founding two great trading companies, one for the East Indies and one for Brazil. His great strength of character stood him in good service after the terrible earthquake of Lisbon on 1st November, 1755, for when the king, unnerved and in despair at the tide of horrors accompanying that event, asked what was to be done, he quietly replied, "Bury the dead and feed the living," and he so sustained his own counsel as to greatly mitigate the distress which prevailed. His reforms naturally gave great offence to the priests and nobles whom he restrained, and in 1758 a conspiracy against the life of the king on the part of the nobles was discovered and frustrated by Pombal. This discovery placed the lives of many of his enemies in his hands, and he took terrible vengeance upon them. The Duke of Aveiro and the Marquis of Tavora were broken upon the wheel, the sons and son-in-law of the former being strangled and the wife of the marquis beheaded. He professed also to suspect the Jesuits of complicity in the plot, and procured against them a sentence of banishment. They refused to obey this decree, but Pombal had them arrested by the soldiers, placed on shipboard, and transported to the States of the Church, and when the papal nuncio was sent to protest he was shown across the frontier. As long as Joseph I. lived Pombal retained his power, but on the death of that monarch in 1777 he was dismissed from office and ordered to retire to his estate at Pombal, where he died 8th May, 1782. The finest parts of Lisbon were built according to his designs after the earthquake, and he introduced into the country numerous distinguished foreigners to instruct the Portuguese in navigation, ship-building, &c. With the commonalty he was very popular, and the peasants long spoke of him admiringly as "the great marquês."

POMEË, in botany, is the name given to the inferior compound many-celled succulent fruit, characteristic of the suborder **POMEË**, such as the apple, pear, quince, &c. The pome is a spurious fruit, the fleshy portion being formed by the greatly dilated calyx-tube, in which the true carpels are embedded.

POMËL, is a suborder of the order of plants **ROSACEÆ**, containing many well-known edible fruits, as the apple, pear, medlar, quince. They are trees or shrubs

with alternate stipulate leaves, and regular flowers, solitary or cymose. The calyx is superior, five-toothed, the petals are five, the stamens numerous, and the carpels one to five, more or less united together or with the sides of the calyx-tube. The fruit is a pome. Besides the plants producing the edible fruits mentioned above, this group contains the hawthorn (*Cratægea*), Cotoneaster, Photinia, and other less known genera.

POMEGRAN'ATE (*Punica Granatum*), a species of plants placed by Bentham and Hooker in the order LYTHRARIÆ, though others consider it more nearly allied to the myrtles (*Myrtaceæ*). The pomegranate has been cultivated in warm countries from a very early period for the sake of its edible fruit, which is mentioned in the Odyssey and the Old Testament, and is represented on ancient Assyrian and Egyptian sculptures. Its origin was probably in South-west Asia, where it is still found wild. In the wild state it is a thorny bush, but under cultivation it forms a low tree from 15 to 25 feet in height, with opposite, oblong or lance-shaped entire dark-green leaves. The flowers (see Plate) are axillary, usually of a crimson colour, with a leathery tubular calyx divided at the top into from five to seven valvate lobes and as many crumpled petals. The fruit is about the size of a large orange, and has a thick leathery rind, formed by the enlarged calyx-tube, of a deep golden colour tinged with red. Within it appears to consist of a large number of reddish berries closely packed together. Structurally this peculiar fruit is composed of two whorls of carpels, placed one above the other, the lower consisting of three or four, and the upper whorl of from five to ten carpels. The seeds are numerous, each embedded in a reddish pulp which contains a refreshing sweet or slightly acid juice. This pulp, which is the valuable part of the fruit, is also used in warm countries in the preparation of cooling drinks. The rind, especially in fruits with an acid juice, contains a large quantity of tannin. It is used medicinally as an astringent in diarrhoea, dysentery, &c., and is also employed for tanning morocco leather. The bark of the roots also contains tannin, and has been used as an anthelmintic, especially in cases of tapeworm. The flowers yield a red dye.

Pomegranates are imported in small quantities into England from Portugal and Northern Africa. The tree is also cultivated in this country as an ornamental plant, and can be grown successfully in some parts in the open air, but the fruit is worthless.

POMEL'LO and **POM'PELMOUSE** are names under which the fruits of the SHADDOCK (*Citrus decumana*) are often sold in England, the latter name being especially applied to those of larger size. The smaller fruits are also called "forbidden fruit."

POMERA'NIA (in Ger. *Pommern*), one of the provinces of Prussia, is bounded on the N. by the Baltic, on the E. by West Prussia, on the S. by Brandenburg, and on the W. by Mecklenburg. It is a long tract of coast, extending 200 miles on the Baltic, and varying in breadth from 30 to 80 miles. The area is 12,000 square miles, and it is divided into the three governments of Cöslin, Stettin, and Stralsund. In the latter is included the fertile and populous island of Rugen, only about half-a-mile from the mainland, which formerly belonged to Sweden, but was transferred to Prussia in 1815.

Pomerania is one of the lowest and flattest countries in Germany. The soil consists of sand, mixed in some places with clay, and is not very fertile. The coast is low, and the province is crossed in its broadest part by the Oder, which, flowing through a marshy tract, divides into many arms or channels, one of which, the great Regelitz, forms, towards its mouth, the Great Danmer Lake, and, together with the main stream, falls into the extensive inland water, the Frische Haff, the eastern part of which is called the Great Haff and the western the Little Haff. The water

of the Haff is fresh, and it is only during the prevalence of the north wind that it is rather brackish and considerably higher, owing to the influx of the sea. The two great islands of Usedom and Wollin separate it from the Baltic, with which it is connected by three outlets. The other rivers of Pomerania are the Persante, Stolpe, Ucker, Peene, and Ihna. There are many small lakes: that of Madino, which is celebrated for its lampreys, is one of the largest.

The climate is cold, and storms on the coast are not uncommon. The natural productions of the country are—horses, horned cattle, sheep, goats, swine, small game, domestic poultry (especially geese), sea and river fish, and bees; corn (including wheat, barley, rye, and oats), peas, beans, potatoes, fruit, timber, flax, hemp, and tobacco; alum, bog iron, salt, turf, and amber. The Pomeranian forests are very extensive and productive. The fisheries likewise yield a considerable profit, numbers of salmon and sturgeon being caught in them. The trade in smoked poultry is extensive, and the commerce of the province is altogether very important. The inhabitants are principally employed in agriculture, and the rearing of cattle and poultry; but shipbuilding, manufactures of good and strong linens and woollen stuffs, and iron and glass wares, tanning, brewing, and distilling are carried on. The manufactures are confined to the principal towns. The active transport trade between the neighbouring Prussian states and the Baltic ports constitutes a very important source of wealth to the province.

The inhabitants are by descent partly Slavonians and partly Germans. The nobles are numerous, chiefly consisting of German families who have settled here since the twelfth century. The vassalage of the peasants was abolished by Frederick William III. The population in 1880 was 1,540,034, nearly all of whom are Lutherans.

Pomerania was formerly a considerable part of the ancient kingdom of the Wends or Vandals, and from the year 1062 it had its own dukes. The Christian religion was introduced in the twelfth century. The line of the dukes became extinct on the death of Boleslaus XIII., in 1687, when Pomerania was divided between Prussia and Sweden; and it was not until 1815 that the former state obtained possession of the whole, by certain arrangements with Sweden and Denmark.

POMMER, the German corruption of the Italian *bombardo*, a mediæval wooden wind reed instrument of various sizes, ancestor alike of the clarinet oboe, and bassoon. The *bombardone* or bass-bombardo was the heaviest base instrument of the time; and our modern large brass instrument the bombardon derives its name from this source, though belonging to quite another family of instruments.

POMO'NA was the Roman divinity of orchards, the apple-goddess (Lat. *pomum*, an apple). Her love affairs with Picus, Vertumnus, and other sylvan gods served the poets for subjects. Like many deities of the Romans little is known of Pomona in proportion to the considerable extent of her worship. A priest was supported by the state for her worship.

POMONA or **MAINLAND**, an island of Scotland, near the centre of the Orkneys, of which it is the largest, being about 24 miles long by 1 to 15 broad. It is deeply indented on all sides except the west, which is nearly continuous. But on the west and north-west the coast is more bold and rocky, and here the violence of the waves has worn out some large caverns. The interior is not elevated, and though much of the surface is covered by heath, there is much arable and meadow land. The best anchorages are at Kirkwall Bay, Deer Sound, Holm Sound, and Stromness. The area is about 150 square miles, and the population in 1881 was 17,185.

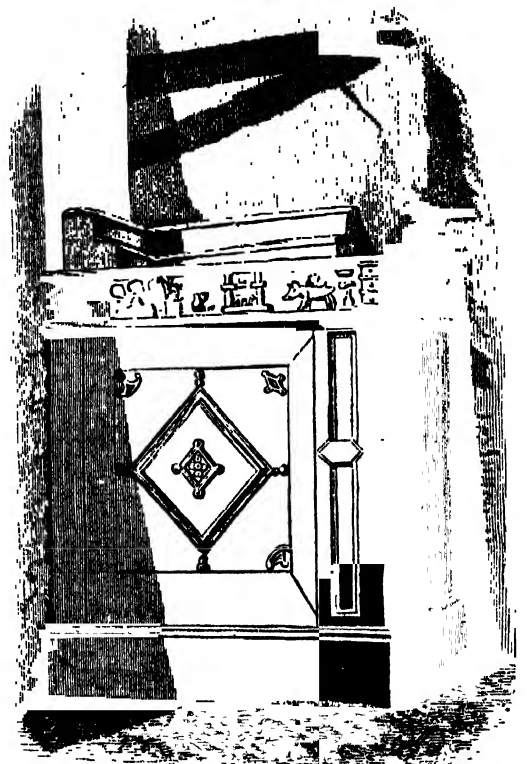
POMPADOUR, **MARQUISE DE** (JEANNE ANTOINETTE POISSON LE NORMANT D'ETTOLES), a notable

mistress of Louis XV., was born in Paris on the 29th of December, 1721. She was baptized as the daughter of François Poisson, a clerk in the household of the Duke of Orleans, by his wife Madeleine de la Motte, but the honour of her paternity as well as that of her brother was understood to belong to a wealthy farmer-general, Le Normant de Tournem, who charged himself with her education and introduced her to society. In 1741 she married a nephew of her protector, Le Normant d'Étiolles, who was passionately in love with her; but though her marriage gave her position and independence, it failed to bring contentment, and she left no opportunity unused of obtaining the notice of the king. Her mother had filled her mind with the ambition of becoming the king's mistress, and when in 1744 she contrived to meet Louis XV. at a ball, her beauty and vivacity at once captivated him, and she was immediately installed as his principal favourite. The following year Louis bought her the estate of Pompadour, from which she took her title of marquise, and in a short time she obtained such complete control over the indolent king, that not only the entire affairs of the court but of the kingdom were managed according to her will. When the king began to weary of her charms she retained her ascendancy by constantly devising new pleasures for him, establishing a private theatre, in which she acted with the chief courtiers in tragedies and comedies, operas and ballets. When this resource failed she procured for his Majesty a succession of fresh mistresses, and retaining her power accepted the position of *amie nécessaire*. She also contrived that the ministers should meet in her room, and she prepared all business for his consideration, so that after a time the choice of ministers, ambassadors, and generals depended upon the interests or caprices of a courtesan, while the traditional foreign policy of the country was set aside, and another substituted at her bidding. Previous to her advent to power the French court had sought for alliances in Germany, in order to weaken the power of Austria; but Frederick the Great satirized madame in some of his indifferent verses, while Maria Theresa, at the instigation of the Austrian prime minister, addressed her in a friendly letter as "ma cousine," and an alliance between France and Austria was the result. As this alliance resulted in the Seven Years' War, the battle of Rosbach, and the loss to France of Canada, it is plain that Europe as well as France has cause to remember the foreign policy of the marquise. The sums of money which from national, royal, and other sources poured into her hands during the twenty years of her ascendancy were enormous; and the total amount, if some MS. accounts preserved in the archives of the department of Seine-et-Oise, and published in 1858, are to be trusted, exceeded 86,000,000 livres. Of this wealth she made a splendid use, bestowing large sums in charity and in the encouragement of literature and art. Voltaire was her poet-in-chief, and Crébillon, Diderot, Vanloo, Boucher, Greuze, and many other artists and litterateurs received her patronage. At the same time she was vindictive as well as imperious; and while she dismissed the chief ministers of the king, and the chief personages of the state who resisted her will, a larger number of persons of minor importance suffered perpetual imprisonment for offences, real or imaginary, against her pride and ill-acquired power. The excitement and stress attendant upon her position at court told upon her seriously as she drew near to middle life, and at the age of forty-two she found herself at the end of her career. When apprised that death was at hand she caused herself to be richly attired, and with her face rouged she lay upon a couch in the palace at Versailles, distributing, through the medium of the king, honours and places to the courtiers who thronged round her deathbed. She was buried in the Church of the Capucins, Place Vendôme, Paris. There are several lives of Madame de Pompadour,

one of the best being that of Campardon, published in Paris in 1867. Two volumes of her correspondence were also published by M. Malagais in 1878, and a further volume of her letters was issued by M. Bonhomme in 1880.

POMPEII, an ancient town of Campania, situated about 18 miles south-east from Naples, in a plain at the foot of Vesuvius, through which runs the little river Sarno. Pompeii, as well as the neighbouring town of Herculaneum, is said by Strabo (p. 247) to have been originally possessed by the Osci, and then by the Tyrreni and Pelasgi. It afterwards fell under the power of the Greek colonies of Cumæ and Parthenopæ, and lastly of the Samnites (about 440 B.C.), who made themselves masters of this coast as far as the river Silarus. About eighty years later the inhabitants of Campania threw off the yoke of the Samnites, and placed themselves under the protection of Rome. In the Social War (90 B.C.) the Campanian towns revolted, and Pompeii, among them, joined the Marsian confederacy. In 63 A.D.

Fig. 1.

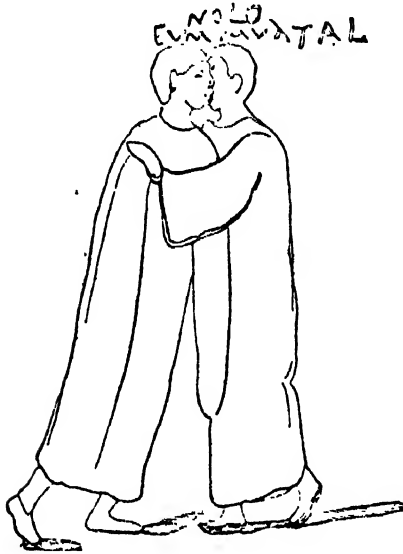


White Marble Altar in the house of the banker L. Cincilius Jucundus, Pompeii.

a terrible earthquake, which vented its chief force on Pompeii, showed that the earth in the neighbourhood was in a state of disturbance, and in A.D. 79, in the month of August, the first recorded eruption of Vesuvius took place, which is described in a letter of the younger Pliny. Pompeii was buried under showers of stones, cinders, and ashes, which in course of time became a bed of earth, and corn was sown and the vine planted over the buried town. The town was rediscovered in 1748, and subsequent explorations, which are being still systematically continued, show that it was inclosed by walls, and built in the form of an irregular ellipse, longest from east to west. The circumference of its boundaries amounted to 2848 yards. In consequence of the prolonged peace, however, the walls

had entirely lost their importance at the time of the catastrophe. Towards the sea they had been demolished, and outside the Gate of Herculaneum a considerable suburb

Fig. 2.

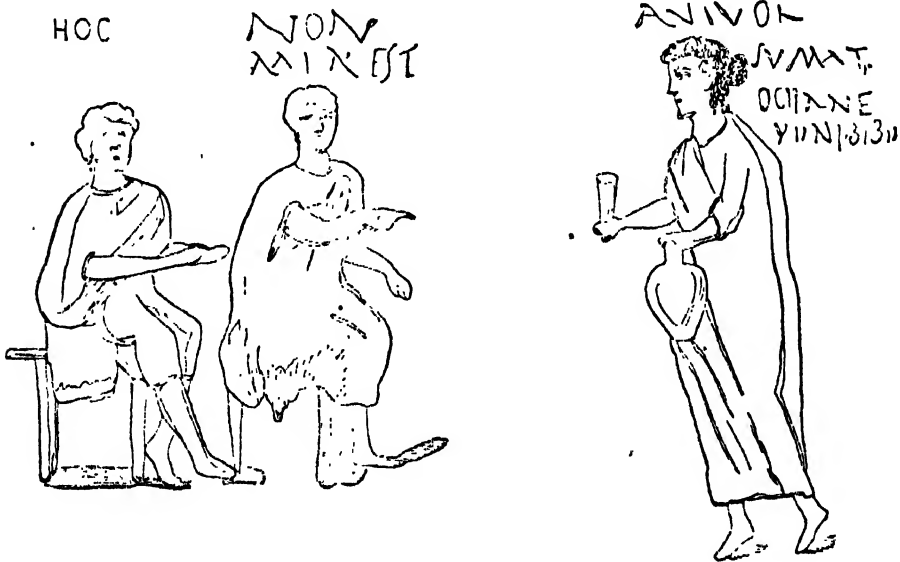


had sprung up. The houses are slightly built of concrete (small stones consolidated with cement) or of brick, and parts of them, particularly the corner pillars, are of blocks of stone. The hasty and patched character of the con-

struction is accounted for by the earthquake of 63, for there had not been time to repair the injuries caused by it. The paved streets, bordered by raised side walks, are straight and narrow, not above 24 feet in breadth, the narrower lanes 14 feet only. These all converge upon the forum—the centre of the city's life. Here are considerable remains of beautiful temples, with their marble columns and sculptured altars. On some are delicate carvings representing sacrifice, in high relief, every detail of leaf, flower, and figure clear and sharp as when first chiselled. On the inner walls of the houses of the city are nymphs and goddesses, classical fables and legends in fresco. Everywhere stand the remains of sculptured fountains—at the street corners, in every house, in every square, and everywhere the use of bright colours made the town attractive under the Italian sun. The statuettes, medals, mosaics, wall paintings, domestic and trade utensils, account-books, various articles of food, clothing, and ornament, and, in fact, all the varied objects which are continually being discovered, and which present collectively the materials for a reproduction of the ancient life, have been placed in the Museum of Naples and in a small museum at Pompeii itself. A graphic sketch of Pompeii "as it was" will be found in Lord Lytton's admirable romance, "The Last Days of Pompeii," whose antiquarian details are remarkable for their accuracy.

Among the most striking things in Pompeii are those which show the suddenness of its overthrow. An election was going on, and the citizens were requested to vote for the respective candidates by enthusiastic supporters, who scratched or daubed their appeals on the walls; the batch of bread put in by the baker, and hardly yet done to his mind, was "drawn" by strange hands eighteen centuries after; the fuller's lye-pots, the vintner's jars, the confectioner's cakes were found in the shops. Up to within a few years back everything of value was taken to the museum at Naples, but the present generation has more

Fig. 3.



wisely retained as much as possible *in situ*, and placed what could not be safely so left in a most interesting museum at Pompeii. But the great age of the place tells upon the painted work laid bare, and any severe weather damages it. Even simple exposure soon dulls the tints, whose surprising

freshness is the ever-renewed wonder of their discoverers when they are first unearthed. Great pains is therefore taken now to sketch all frescos, &c., directly they are discovered; and moreover, quite contrary to the practice of the editors of the magnificent tomes of past days, who

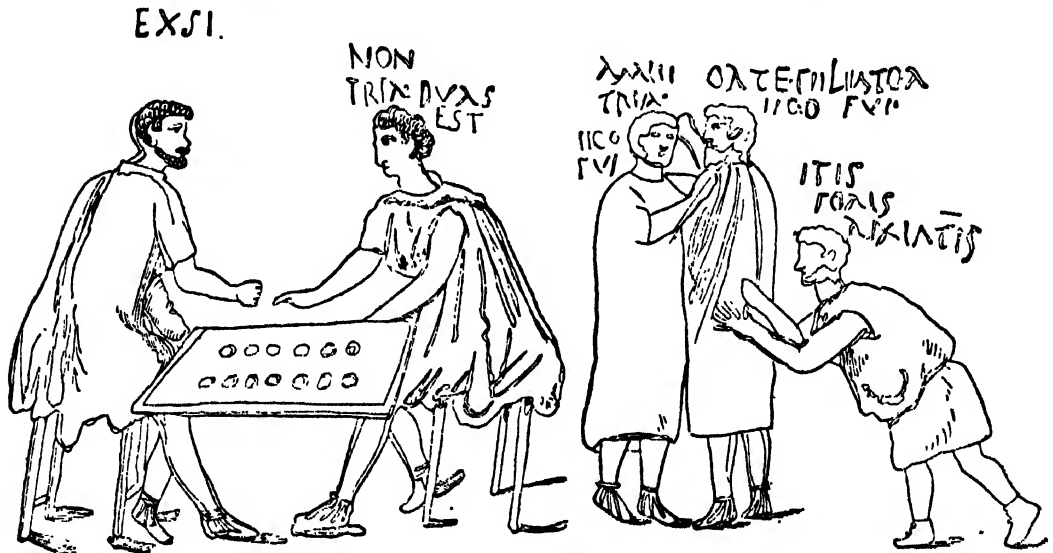
sought to idealize (or, vulgarly speaking, "to touch up") the designs they perpetuated, the aim of the artists and archaeologists of to-day is to preserve every defect along with every beauty. Pompeii was in the act of being decorated when it was buried. The earthquake had half ruined it in 68 A.D., and numbers of new houses had been required. Artists of merit prepared designs, and these designs were somewhat roughly put upon the walls by ordinary painters. Thus it is that with such clever poses and harmonies of colour we have such indifferent execution. The style in which the best houses are decorated is shown in Plate I., which is from the house of the banker L. Cæcilius Jucundus (excavated in 1875). A large pile of the banker's "account-books" (tablets in frames, like schoolboys' slates, prepared with wax and written on) were found in the business room of the house. These have been deciphered in great numbers, and are very curious and interesting. The banker's portrait bust, showing him a handsome man of about fifty, decorated his hall. The decoration given is part of that of a wall of the *tablinum*: and in a panel are a pair of lovers, crowned with garlands,

possibly portraits; in the other a very fair dramatic presentation of Iphigeneia in Tauris, advancing, as priestess of the temple, to sacrifice her brother Orestes. A large fault in the plaster deprives us of the figure of Orestes. This picture has been taken to Naples. In the great hall (*atrium*) stood the *house-altar*, of white marble (fig. 1, p. 122), and it bears upon it as a frieze decoration a bas-relief showing the well-known (still existent) temple of Jupiter in the forum, and the two equestrian statues in front of it, tottering under the throbs of the earthquake. To the right a bull is being led to the altar of the temple of Venus for sacrifice to avert ruin from the trembling city. The altar is not quite finished, and it was no doubt being erected as a thankoffering for preservation from the great danger. The work is extremely beautiful, and the localities excellently shown and easily recognizable. The most unromantic can hardly help feeling "the pity of it."

Pompeii is divided into blocks by streets, like every other town; and everything is so accurately named that it is as easy to find a special house as if one were threading the streets of a modern town. The block from which our

Fig. 4.

Fig. 5.



second Plate is drawn (figures in wall decorations) is Block 5 in District ix., and is bounded by Decumanus Major and Nola Avenues, and by First and Fourth streets. The block has seven houses and twenty-two doors (numbered 1 to 22, as in our own towns), six being dwelling-houses with shops in front, and the seventh a bakehouse. One of the dwelling-houses (Nos. 1, 2, 3 Decumanus Major) is known as the "house with the skeletons," for ten were found there. The house No. 8, 9, 10 in the same street (Nos. 8 and 10 being shops, one each side of the vestibule No. 9, in the usual Pompeian fashion) is known as the "house with the Nile pictures", from the decorations of its garden walls, showing the banks of the Nile, with plenty of crocodiles, palms, native boatmen, &c. The atrium of the house, whence the owner could watch the conduct of his slaves in his two shops, through large windows, is very prettily decorated with figures on plain red panels, Venus and five Cupids (*amorini*), not only painted with rather more care than the usual Pompeian work, but adorned with touches of gold. Our Plate (II.) shows one of these amorini bearing a toilet box, and a palm-leaf fan for the goddess. The next house is interesting as having been struck by lightning in

the great eruption, as its broken and melted stones and glass testify. The house beyond that, the corner of the block, caught fire, but is not very much damaged, and is one of the best decorated houses in Pompeii. It bears the name of the "house with the Muses," these goddesses being represented on one of the walls—a group of eight. (The number often varied with the ancients, though nine was the most usual.) Our figure in Plate II. comes from the hall where the seasons are painted, and we have chosen the pretty figure of Summer.

The painters of eighteen centuries ago were not unlike their brethren of to-day, and consequently it is amusing to find them bedaubing the walls of the tavern they affected with numerous portraits, caricatures, &c., just as the modern custom is with their successors. One of the artists (fig. 2, p. 128) was caught coaxing the pretty maid-servant till she promised him to have "nothing to do with Murtal" (*Nolo cum Murtal*), and was accordingly put upon the wall by a teasing comrade. "Hero!" (*Hoc*) cries a thirsty soul in another sketch (fig. 8); "No, it's mine" (*Non, mea est*), says his friend; "Oh!" cries the maid, jug and glass in hand, "take your wine; which of you wants it? here,

Oceanus, come on, drink it up!" (*Qui vol.umat; Oceane, veni, bibe.*) The name of Oceanus was, of course, a personal joke, levelled by the maid at a customer who would drink up the sea. In the sketch given opposite (fig. 4) two of the customers are playing dice; "I'm out" (*Èssi*), cries one; "No, you have not thrown three; it's only two," objects the other (*Non tria, duas est*); consequently in the adjoining group (fig. 5) the two have one another by the hair, and are shouting, with a fury scarcely depicted by the tame pencil of the caricaturist, "I did not throw two, I threw three" (*Non 11. a me, tria ego fui*), "Miserable deceiver, I was out" (*Orte fellator, ego fui*), while the fat landlord is pushing them out of his doors for fear of the police (*Illi foras riasatis*), "Go outside if you want to quarrel." The spelling and the grammar of the light-hearted fellows are, as usual with their tribe, not all that could be wished, as will have doubtless been observed.

It is such things as these, seen in considerable numbers, which form the perennial interest of Pompeii.

POMPEIUS MAGNUS, CNEIUS, the elder of the two sons of the triumvir Pompeius [see POMPEY THE GREAT] and of Mucia, was born about 77 B.C. When the war with Cæsar broke out, he was sent to Egypt to collect troops, and he returned to his father's fleet in the Adriatic with fifty ships. After the battle of Pharsalia he remained with the chief part of the naval force at Coreyra; and in the spring of B.C. 47, on his voyage to Africa, he heard of his father's death. He then turned to Spain, where he landed B.C. 46. On the 17th March, B.C. 45, Cneius was defeated by Cæsar at the bloody battle of Munda (Monda, in Granada), and being taken, he was put to death.

POMPEIUS MAGNUS, SEXTUS, the younger son of Pompey the Great, was born in 75 B.C. After witnessing the death of his father in Egypt, he fled to Cyprus with his stepmother Cornelia, and thence to Africa. After the defeat of his party at Thapsus, he retired to Spain to join his brother; but the issue of the battle of Munda destroyed his hopes. Collecting a number of adventurers and the fragments of his brother's army, he made himself master of part of Hispania Tarraconensis. When Octavian, Mark Antony, and Lepidus formed a triumvirate, Sextus was declared an outlaw, and he cruised about the Mediterranean as a pirate, and took possession of Sicily. Antony and Octavian then came to terms with him, B.C. 39, and he obtained the proconsulship of Sicily, Sardinia, and other places. This treaty, however, did not long endure. Sextus Pompey and Octavian quarrelled, and the fleet of Octavian was twice defeated. In B.C. 36 M. Vipsanius Agrippa, who commanded for Octavian, defeated Sextus Pompey in a great sea-fight near Naulochus, and he was afterwards taken prisoner and put to death at Milætos.

POMPEY THE GREAT (*Cneius Pompeius Magnus*, the triumvir) was born on the 30th of September, 106 B.C., a few months after the birth of Cicero. He was six years older than Cæsar. His family was plebeian, but his father, Pompeius Strabo, joined the aristocratic party and fought under their banner in the Marsic war. The son served first in the same war. After his father's death his house in Rome was plundered by the party of Marius. When Sulla was returning from the war against Mithradates, Pompey raised troops at his own cost in Picenum, and opposed the Marian party. The senate were dissatisfied at his acting without their authority, but his army was faithful to him. He joined Sulla, who treated him with the respect which his great success entitled him to and his arrogant temper claimed. He was at this time only twenty-three years of age. Sulla was made dictator, and the civil war still continued, during which Pompey lost no opportunity of distinguishing himself. After the fall of Præneste, Sulla gave him his step-daughter Æmilia in marriage. She was then pregnant by her husband, M.

Labrio, but he was compelled to part with her, and Pompey put away his own wife Antistia. He afterwards commanded in Sicily, from whence he passed over into Africa to oppose Domitius Ahenobarbus, whom he defeated. He also restored King Hiempsal, a friend of Sulla, to the throne of Numidia. After this success, which was the work of a few months only, Pompey returned to Rome, where he was saluted by Sulla, it is said, with the name of Magnus, or the Great. Though he had held no public office, and was still only an eques (one of the order of knights), he claimed a triumph, which he obtained, though Sulla was at first averse to allow it. After Sulla's death (B.C. 78) Lepidus attempted to get the laws repealed which were enacted under Sulla's dictatorship, but Pompey successfully resisted him. Pompey was sent by the senate to oppose a revolt in Cisalpine Gaul under M. Junius Brutus. Brutus, after defending himself in Mutina, surrendered, and Pompey ordered him to be put to death. Lepidus (the ex-consul), also in revolt, was defeated by Pompey and Catulus near Cosa, and he died soon afterwards. After the defeat of Lepidus, Pompey still kept his command, under various pretexts, though the senate had ordered him to lay down his arms; but he soon obtained a legitimate sanction of his ambitious views by being sent to oppose Sertorius in Spain (B.C. 76), with the authority of proconsul. In B.C. 72 Sertorius was assassinated by his own adherents.

While he was on his return through Gaul to Italy, Pompey became a candidate for the consulship, and as he had not held any of the minor civil offices, and could not legally solicit the suffrages of the people, the senate suspended the laws in his favour, and he and Crassus were elected for the year 70 B.C.

In September, 71 B.C., Crassus entered the city in an ovation, and Pompey and Metellus in triumph. Both consuls now did their utmost to gain the favour of the people. Pompey performed his promise of obtaining the restoration of the tribunitian power, which Sulla had caused to be abolished. After the expiration of his consulship he remained at Rome two years without holding any office. His next employment was in the war against the pirates who infested the Mediterranean, and even the neighbourhood of Rome. He was invested with very large powers for three years, and began his operations in the spring of B.C. 67. Within forty days he cleared the sea between Spain, Italy, and Africa, and concluded the war against the pirates by a decisive defeat at Corneconium in Cilicia. The campaign did not last above three months, and yet in this short time 120 towns and castles were taken by the Romans, and above 1600 ships were burnt or captured. Pompey still remained in Asia, and a law was passed at Rome, proposed by C. Manilius and supported by Cicero, which conferred upon him unlimited power for conducting the war against Mithradates (B.C. 66). Mithradates fled before him, and escaped to the Tauric Chersonese (Crimea). Jerusalem was next besieged and taken, and Judea recognized the supremacy of Rome by paying an annual tribute. He had advanced south of Judea to chastise some of the Arab chiefs, when the news of the death of Mithradates induced him to return to Pontus. In January, B.C. 61, Pompey landed at Brundisium, and a few months after his arrival before Rome he celebrated his triumph over the pirates and Mithradates in the most magnificent spectacle of the kind that Rome had seen.

Pompey expected that all his measures in Asia and the distribution of lands which he had promised to his soldiers would be sanctioned by the senate. But he found himself opposed by Cato and the heads of the senatorial party. Upon this he joined the popular party, and thus gained the support of Cæsar. Crassus, the wealthiest of the Romans and the friend of the senate, was also easily won to his side, and these three men now formed what is generally called the first triumvirate. During his consulship,

Cæsar (59 B.C.), by his agrarian law, enabled Pompey to fulfil the promises which he had made to his veterans: large districts of public land in Campania were assigned to them. Cæsar also obtained for him the sanction of the arrangements which he had made in Asia. Pompey in his turn was obliged to support Cæsar, his apparent friend, in all his designs, and thus he rendered himself more obnoxious to the aristocratic party. He had divorced Mucia, the mother of his two sons, and Cæsar, to secure him, gave him his young daughter Julia in marriage.

He now allowed his great eulogist Cicero to be driven into exile by the tribune Clodius; and it was not until the latter had made an attempt to assassinate Pompey that he promoted the recall of the great orator. Gratitude induced Cicero to endeavour to re-establish Pompey in the popular favour, by procuring for him the prefectura annona for five years, and the proconsular power over all provinces, with fifteen legions at his command. In this capacity he went to Sicily, whence he sent provisions to Rome, and thus gained the favour of the people. At the commencement of the year 56 B.C. he repaired to Lucca, where Cæsar had come from Gaul to spend the winter. Crassus also, and many other Romans met there. In April, 56 B.C., the three patricians came to an agreement by which Cæsar's command in Gaul was to be prolonged for five years, and Pompey and Crassus were to be made consuls for the following year, with the provinces of Spain and Africa for the former, and Syria for the latter. Pompey and Crassus were elected consuls after a fierce opposition. Pompey built a magnificent theatre, and amused the multitude with gorgeous spectacles. At the end of the year Crassus went to Syria, but Pompey governed his province by his legates, and remained with his army in the neighbourhood of Rome, where he interfered with the administration of justice, prevented the election of new consuls, and kept up hostilities between the parties at Rome. In September, 54 B.C., his wife Julia died, and when proposals were made for a new alliance with the family of Cæsar, he rejected them. Crassus in the meanwhile perished in the Parthian War.

On the 26th February, 53 B.C., Pompey was made sole consul, but on the 1st of August he made Metellus Scipio, whose daughter Cornelia he had married, his colleague. An old law, that required a candidate for the public office to appear in person at Rome, was directed against Cæsar, who must give up the command of the armies in Gaul if he wished to be elected consul again. Cæsar, though absent from Rome, claimed to be elected consul for the following year. But a decree was made, declaring Cæsar a public enemy unless he resigned his command and came to Rome as a private man, and Pompey was empowered to

Pompey left the city and made his way to Brundisium, leaving general alarm behind him. From Brundisium he crossed over to Dyrrachium in Epirus, after which he made his way into Thessaly; and on the 9th of August, B.C. 48, was encountered by Cæsar on the field of Pharsalia, where he was totally defeated. He fled to Lesbos, whither he had sent his wife Cornelia and his younger son, and from Lesbos to Egypt, to seek refuge with the king. He landed there on the 28th of September, but was treacherously murdered as he touched the shore, in the presence of the King of Egypt and his army, by Septimius, who spared the anger of Cæsar. His wife and child, who were still on board the ship, and saw the murder, hastened away. The murderers cut off the head of the Roman chief and left the body on the beach, where it was buried by a freedman and veteran. Cæsar, who arrived in Egypt three days later, shed tears when the head was presented to him, and put the murderers to death.

POMPEY'S PILLAR, the name erroneously given to a celebrated column in the vicinity of Alexandria, Egypt. It is situated on an artificial mound, about 600 yards south of the city walls. Its popular appellation is now of some antiquity, though how it originated cannot even be surmised, since the inscription on the base plainly states that it was erected by Publius, prefect of Egypt, in commemoration of the conquest of Alexandria by the "invincible" Emperor Diocletian, in 296. The monolith is of red granite, 98 feet 9 inches high, and 29 feet 8 inches in circumference. The shaft, which stands on a pedestal, measures 75 feet in height, is of the Corinthian order, and was anciently crowned by a statue.

POMPIDÆ is a family of insects belonging to the order HYMENOPTERA, and nearly allied to the CHRABRONIDÆ. The prothorax is usually transverse, and broader than long; the abdomen is attached to the thorax by a short peduncle. The wings are large, with three sub-marginal cells, and the antennæ and hind legs are long. About 800 species are known, chiefly belonging to the genus *Pompilus*, and occurring all over the world.

The Pompilidæ are strong and active; they run and fly with great rapidity. These insects burrow in the ground, preferring sandy situations, and store their nests with spiders, which constitute the food of their larvæ. About twenty species of *Pompilus* are British. *Pompilus fuscus*, a very common British species, is a very pretty insect, about half an inch long, of a shining black colour, with the exception of the anterior part of the abdomen, which is red. *Pompilus punctum*, a small British species, constructs cells of mud. The insects of the genus *Cero-pales*, of which two species are British, are said to deposit their eggs in the nests of other species of the family.

PONCE DE LEON, LUIS, a celebrated Spanish poet, was born at Granada in 1527. He studied at Salamanca, where he entered the order of St. Augustine in 1544, took his degree in theology in 1560, and was in the following year appointed professor of the same. His lectures on the Bible were very successful, but his success awakened the envy of some of his colleagues, and having published a new translation of the Song of Solomon, he was at their instigation summoned, in 1572, to appear before the Inquisition at Valladolid to answer to the charges of heresy and unlawful translation of the Holy Scriptures. He easily cleared himself of the former charge, but had to admit the latter, and as translating the Scriptures was contrary to the decrees of the Council of Trent he was condemned to imprisonment. During the next five years he remained immured in a dark cell, but at the end of this period he was released through the intervention of powerful friends, and restored to his position as professor of theology at the university. At his first lecture a large number of his friends assembled to welcome him, and their feelings of sympathy gave way to those of admiration when he quietly



Coin in British Museum (actual size).

[This coin was not struck by Pompey himself, but by his son Sextus, as appears from the surname *Pius* in *Magnus Pius, Imperator iterum, Prefectus classi et ora maritimæ ex Senatus consulto*. It must have been struck at the time when Sextus had taken possession of Sicily and assumed the title of Imperator for the second time. The single head on one side is supposed to be that of Pompey the triumvir, and the two smaller heads to be those of his two sons.]

raise troops. The intelligence which swiftly followed this decree, that Cæsar had crossed the Rubicon, the boundary of his province, and was marching on Rome, showed the emptiness of the arrogant boasts of the senatorial favourit

took up the thread of the addresses which had been so long interrupted, with the words "as we observed in our last lecture." He was subsequently raised to the rank of vicar-general of the province of Salamanca, and died at Madrigal, 23rd August, 1591. During his lifetime he published a Latin commentary on the Song of Solomon, which was accepted without objection by the orthodox, and two eloquent religious works in prose, "De los Nombres de Cristo" (on the Names of Christ), 1583-85, and "La Perfecta Casida" (The Perfect Wife), 1588; but his experience of the Inquisition had imbued him with caution, and the poetical works upon which his fame chiefly rests were not published until 1631, forty years after his death, when they were issued by Quevedo at Madrid, under the title "Obras Proprias y Traducciones Latinas, Griegas y Italianas; con la Paraphrasi de Algunos Salmos y Capítulos de Job." They consist of translations from Virgil, Horace, and other classical authors, and from the Psalms, with some original lyrics, which, from their force and beauty, are treasured among the masterpieces of Spanish literature. The poems of Ponce have been many times reprinted, and a complete edition of his works appeared at Madrid, in six vols. (1804-16). See also Ticknor's "History of Spanish Literature" (third edition, 1861).

PONCHO (Spanish), a species of cloak worn in Chili and some other parts of South America, consisting of a piece of woollen cloth, about 2 yards long, by 3 or 4 feet broad, having in the middle a slit, through which the wearer thrusts his head, leaving the garment to hang down before and behind. Some attempts have been made to introduce this simple, and in some circumstances picturesque garment into Europe, and waterproof ponchos of varnished cotton cloth or rubber-cloth are worn by some of the mounted troops of America. A modification of the poncho is humorously referred to by Carlyle, in the opening book of "Sartor Resartus." "The simplest costume which I anywhere find alluded to in history is that used as regimental by Bolivar's cavalry in the late Columbian wars. A square blanket, 12 feet in diagonal, is provided (some were wont to cut off the corners and make it circular); in the centre a slit is effected, 18 inches long; through this the trooper introduces his head and neck, and so rides shielded from all weather, and in battle from many strokes (for he rolls it about his left arm), and not only dressed, but harnessed and draped."

POND, JOHN, astronomer-royal, was born about 1767, in London, and was educated at Trinity College, Cambridge. Having been obliged, from the ill health which attended him almost through life, to spend several years abroad, he settled himself, on his return, at Westbury near Bristol, where he resided till his marriage in 1807. He then removed to London, and in 1811 was appointed to succeed Dr. Maskelyne as astronomer-royal. He retired from this office upon a pension in 1835, and died 7th September, 1886, at Blackheath.

The branch of astronomy to which he devoted himself was the determination of the places of the fixed stars; and in knowledge of the instruments and methods necessary to be used, and sagacity in detecting and avoiding error, the opinion of those who are best able to judge places him second to none of his day.

POND SNAIL (Limnæidæ) is a family of GASTEROPODA, found in fresh waters all over the world. Many species are British, common in ponds, ditches, rivers, and streams. They feed chiefly on decaying vegetable matter, and come to the surface at intervals to breathe. When attached to aquatic plants they can lower themselves gradually by means of a glutinous thread, and re-ascend by the same means. They deposit their eggs enveloped in a glairy substance like clear jelly, on the leaves of water-plants, or on stones, but generally on the former, and these are often to be found on the leaves of water-

creases brought to the table. In the typical genus *Limnæus* the shell is spiral, more or less elongated, very fragile and translucent, with a large aperture and a sharply pointed spire. The animal has a short, broad head, bearing two flattened tentacles, with sessile eyes at their inner bases. The pond snails are frequently to be seen gliding, shell downwards, on the surface of the water by an undulatory movement of the foot. When the pond in which they live dries up, they bury themselves in the mud, protecting the aperture of the shell by a membranous epiphragm. *Limnæus truncatulus* is interesting as being the intermediate host of the liver fluke (*Fasciola hepatica*), which causes the "rot" in sheep. It is by grazing in marshy places where these snails abound that the parasite is introduced into the sheep's body. About ninety recent species of *Limnæus* have been described, and seventy fossil, the latter commencing in the Wealden, and found in various fresh-water formations in Britain and France. In the nearly allied genus *Planorbis* the shell is discoidal, with a depressed spire and many whorls. The species are numerous, inhabiting chiefly stagnant waters; many recent and fossil species are British. *Physa*, the bubble snails, and *Ancylus*, the river limpets, also belong to this family.

POND WEED (*Potamogeton*) is a genus of monocotyledonous plants belonging to the order NAIADACEÆ. The pond weeds are submersed or partially floating plants, abounding in rivers, canals, lakes, and ponds, in Britain and Europe, and found also in most parts of the world. The flowers are hermaphrodite, sessile on a spadix, greenish in colour, with a perfect four-cleft perianth, four anthers, and four pistils. *Potamogeton natans*, a common British species, has the lower leaves submersed, very long and narrow, while the upper leaves are floating and broader. Other species have only submersed leaves. In canals the pond weeds sometimes grow so profusely as to impede navigation. The herbage affords shelter to aquatic insects, and the seeds form part of the food of many aquatic birds, and swans are very fond of the roots.

PONDICHERRI (*Puducheri*), the chief settlement of the French possessions in the East Indies, is surrounded by the Cuddalore *tâluk* of South Arcot District, Madras. The town lies in 11° 55' lat. N., and 79° 52' lon. E., 85 miles S. by W. from Madras. The first French settlement at Pondicherry was in 1674, under François Martin. In 1693 it was captured by the Dutch, but restored in 1699. It was besieged four times by the English. The first siege, under Admiral Boscawen, was unsuccessful. The second, under Colonel (afterwards Sir) Eyre Coote, in 1761, resulted in the capture of the place, but it was restored in 1763. It was again besieged and captured in 1778 by Sir Hector Munro, and restored in 1785. It was captured a third time by Colonel Braithwaite, in 1793, and finally restored in 1816.

The territory of Pondicherry comprises three districts—Pondicherry, Villianur, and Bahur—containing 93 large villages and 141 hamlets. Its area is 112 square miles, and its population 160,000. The town of Pondicherry, which has about 50,000 inhabitants, is divided into two parts, the White Town and the Black Town, separated from each other by a canal. The White Town is by the seaside, and is well built. The chief public buildings are—Government House, the parish church, the Foreign Missions church, two padogas, the new *bâzâr*, the clock tower, the lighthouse, the barracks, the military hospital, and the town hall. There is also an exceedingly neat iron screw-pile pier, and a supply of drinking water has been brought into the town which for purity is perhaps unrivalled in any other town in Southern India.

A colonial college and 172 other schools, attended by nearly 5000 children, provide for the educational wants of the territory; and a public library of 12,000 volumes, a

Catholic mission, two orphanages, and two refuges are among its institutions. The chief industries are weaving and dyeing. The former has of late years languished in consequence of European competition. In 1879 railway communication was opened between Pondicherry and the South Indian system. The French are debarred by treaty from restoring the fortifications, or from maintaining any force beyond what is necessary for the purposes of police. Sir C. Trevelyan described Pondicherry as "more European than any Anglo-Indian place. It is like a small European town transplanted to the shores of the Indian Ocean. It is teeming with intelligence and enterprise."

PONIATOWSKI, a celebrated princely family of Poland, the origin of which is somewhat obscure, but of which the first distinguished member was Count Stanislaus Poniatowski, who was born at Dereczyn, in Lithuania, in 1677, and during the war of the Polish Succession rose to the rank of major-general in the army of Charles XII. After the death of Charles he gave his adhesion to Augustus II., who made him in 1724 grand treasurer of Lithuania, and in 1731 palatine of Mazovia. On the death of Augustus II. he at first sought to effect the promotion of Stanislaus Leszczynski to the throne, but ultimately became reconciled to Augustus III., who raised him to high office, and in 1752 appointed him castellan of Cracow. He died 3rd August, 1762, leaving four sons, of whom the most celebrated was Stanislaus Augustus, king of Poland from 1764 to 1795.

After him on the roll of fame must be placed Joseph Anton Poniatowski, son of Andrea Poniatowski, and grandson of Stanislaus, prince and marshal of France, who was born at Warsaw, 7th May, 1762. He entered the Austrian service, and became colonel of dragoons and aide-de-camp of the Emperor Joseph II., with whom he made a campaign against the Turks in 1787. In 1794, when the Poles rose against the Russians, Joseph Poniatowski served under Kosciusko, but his countrymen being defeated, he was obliged to emigrate, and he retired to Vienna. In 1798 he returned to Warsaw, and afterwards took the command of the Polish army which rendered such great services to the French during the campaign of 1807 against the Russians. When the war broke out between France and Russia in 1812, Poniatowski obtained the command of the fifth corps of the Grand Army, which was composed entirely of Poles. He maintained the strictest discipline in his corps, which in the disastrous retreat from Moscow distinguished itself by its orderly behaviour. Compelled to evacuate Warsaw he withdrew into Saxony, but in the following campaign of 1813 fought with his usual bravery in various battles, and was made a marshal of France by Napoleon just before the battle of Leipzig. A few days after (19th October), being pressed by the enemy upon the banks of the Elster, which was swelled by the rains, he spurred his horse into the river and was drowned. His body was found on the 24th and buried on the 26th, after being embalmed. In 1816 it was exhumed and carried to Warsaw, whence it was afterwards removed to Cracow and placed by the side of the remains of Sobieski and Kosciusko in the sepulchre of the Polish kings.

A great grandson of Stanislaus, Prince Joseph Poniatowski, only deserves mention as the last legitimate scion of his house. He was born at Rome, 21st February, 1816, and educated at Florence. He entered the Tuscan service, and in 1849 was sent as plenipotentiary to London. In 1850 he removed to Paris, and after becoming a naturalized citizen of France, he was, in 1854, made a member of the Senate. During the reign of Napoleon III. he was intrusted with several extraordinary diplomatic missions, but after the downfall of the empire he found it necessary to remove to London, where he supported himself by teaching music. He was the author of several operas, some of which attained moderate success. He died in London, 3rd July, 1878.

PONS VARO'LII. See BRAIN.

PONTA DELGA'DA, the largest town, though not the capital, of the Azores Islands, situated on the south coast of the island of St. Michael. It is defended by a castle and forts, and has numerous churches. The houses are substantial, but the streets are ill-paved and filthy. Contrasted with other towns in the Azores, it displays considerable wealth and industry. The exports consist of oranges, wines, brandy, and rocella. Works have been carried out which have rendered the harbour capable of receiving the largest vessels.

PONTAGE (Lat. *pons*, a bridge), in the middle ages, a toll levied or contributions made for the building or maintenance of bridges. This was accounted one of the three public charges on the nation, from which none were exempt, not even bishops, abbots, or monks, as Selden informs us.

PONT-DU-GARD. See BRIDGE.

PONTERERIA/CLE is an order of plants belonging to the group MONOCOTYLEDONS. The species are aquatic or marsh plants, with alternate, sheathing leaves, sometimes cordate or sagittate, and flowers in a spike or raceme. The perianth is tubular, coloured, six-partite; the stamens are three to six; the ovary is three-celled, with a single stigma. The fruit is a three-celled, three-valved capsule, containing numerous seeds. They are natives exclusively of North and South America, the East Indies, and tropical Africa. Very little is known of their uses. Some of the species are employed by the native Indian practitioners in liver complaints and diseases of the stomach. About thirty species are known. *Pontederia cordata* (the pickerel weed) is a common aquatic plant in North America, having sagittate leaves, and a dense spike of blue flowers with a two-tipped perianth.

PONTFRAC (usually called *Pomfret*), a market town and municipal and parliamentary borough of England, in the county of York, situated 24 miles S.S.W. from York, and 178 from London, on an eminence about 4 miles S.S.E. from the junction of the Calder with the Aire. It has a station on the Knottingley branch of the Great Northern Railway. The town is well built, and its market, erected in 1860, is a handsome building. The streets are spacious and clean, and the town contains a town-hall, a market-hall, and two churches, one of which, All Saints', was rebuilt in 1867. The importance of the town has been greatly increased since it has been a military centre. It has iron-works, tanneries, sacking factories, breweries, and brick-works. The origin of the name is uncertain. The ruins of the celebrated castle are situated on a rocky eminence. Architecturally they are not important, but their historical associations are numerous. The castle was founded soon after the Conquest by Albert de Lacy, who held it until 1810, when it passed to Thomas Plantagenet, earl of Lancaster, and afterwards to John of Gaunt. It was the last of the king's garrisons to surrender in the Civil War, and was dismantled by order of Parliament. Here Thomas of Lancaster was beheaded in 1322; Richard II. starved or "hacked" to death in January, 1399-1400; James I. of Scotland imprisoned in 1405; and Earl Rivers and his chief associates beheaded in 1483. The municipal borough is governed by six aldermen, eighteen councillors, including a mayor. Since 1885 the parliamentary borough has only returned one member to the House of Commons. Up to that time it had two representatives. The population in 1881 was 15,882.

PONTIFEX was the name by which the Romans designated a member of the most illustrious of their great religious corporations or colleges. It is a great mistake to call the pontifices, or the great corresponding college of augurs, priests. They were not, like the priests, devoted to the service of any god in particular, but were the depositaries of religious lore and ceremonials. They were close

corporations, recruiting their ranks by co-optation, rigidly (for many centuries) limited to the patricians. There were six augurs, divining the messages of the gods sent in the form of birds' flight, and four pontiffs, with a fifth or chief pontiff (*pontifex maximus*) as their head, who alone knew the proper ceremonies for averting the anger of the river-god in the work of bridging the sacred river Tiber. Pontifex (from Lat. *pōns* and *facio*) simply means bridge-builder. The work intrusted to the pontiffs soon led them to become engineers, and hence road-constructors, and *pōns* came to mean a road as well as a bridge; whatever knowledge of such matters there was came to them. Hence they became authorities on measures and numbers—state calculators. Thus grew up their function of regulators of the dates of seasons, months, &c., and of the feasts of the calendar; and they had to fix the right time for every religious ceremony. Their control of religious functions in general included marriages, testamentary documents, law-sittings, &c. It is evident, therefore, that the chief pontiff, who held the bulk of the power of the college, was an exceedingly powerful Roman official.

When the great state offices had become accessible to the plebeians, these also obtained the privilege of being represented in the college of pontiffs by members of their own order. This change was brought about in 800 n.c. by the Ogulnian Law, by which the original number of pontiffs, through the addition of four plebeians, was increased to eight, by including the chief pontiff, to nine. The chief pontiff, however, continued to be selected from the patricians to the year 254 n.c. In 81 n.c. Sulla increased the number to fifteen, and later on Caesar added a sixteenth pontiff.

The pontiffs had a general superintendence over religion, and such matters as were specially connected with religious celebrations. Their offices were for life. The rules of law applicable to all matters included in the jurisdiction of the pontiffs were comprehended under the term *Jus Pontificium*. Augustus was made Pontifex Maximus, and his successors held the same office to the time of Gratian or later. The letters P. M. on the coins of the Roman emperors denote Pontifex Maximus. When the emperors ceased to call themselves Pontifex Maximus, or to direct religious observances, the popes assumed the title, and have ever since retained it.

PONTINE or POMPTINE MARSHES is the name of a low marshy plain of Italy, in the southern portion of the Campagna di Roma, extending along the coast of the Mediterranean for about 24 miles from N.W. to S.E. and varying from 4 to 11 miles in breadth. It is traversed by the railway leading from Rome to Naples.

The Pontine Marshes extend from Cisterna on the north to Terracina on the south, and within this district the waters from the mountains stagnate, on account of the level nature of the ground, and of the accumulation of sand on the coast. The region is generally barren, and extremely pestilential. Part of it is cultivated, and horses, cattle, and buffaloes find pasture. There is every appearance that the basin of the Pontine Marshes was once a gulf of the sea, which has been gradually filled up by the alluvium from the mountains. Several attempts have been made to drain this district: the first, about n.c. 160, by Cornelius Cethegus; a second in the reign of Augustus; and a third in that of Theodorice. Pope Boniface VIII. afterwards drained the country about Lizzo by excavating a large canal, and something was done by Popes Martin V. and Pius VI. The celebrated Via Appia, or the Appian Way, traversed the marshes; it was restored and reopened by Pius VI., from Rome to Albano.

PONTIUS, CAIUS, a brave and successful enemy of the Roman republic. He was general of the mountain folk of Samnium, and at the head of his hardy Samnites defeated the Roman army under the consuls Calvinius and

Postumius Albinus in a narrow pass in the Apennines, not far from Capua, called from the neighbouring town of Caudium, the "Caudine Forks" (n.c. 321). As generous as he was brave, Pontius contented himself with depriving the vanquished Romans of their arms and passing them under the yoke (two spears supporting a third), whilst the consuls swore to a perpetual peace with Samnium. This done, Pontius permitted them to return unharmed. Rome at once shamefully repudiated the treaty, without, however, replacing the army in the power of Pontius, as of course repudiation, if it were to be honourable, demanded. In n.c. 292, in the course of the Samnite wars, Pontius was taken prisoner by the consul, Q. Fabius Gurgus. Having appeared in his victor's triumphal procession the brave chief was murdered, a deed that stains the Roman arms.

PONTTOON' or PONTON (Lat. *pōns*, a bridge). This term is employed by the French to signify any barge or flat-bottomed boat; but in this country it is confined to those vessels which are used in the formation of floating bridges for military purposes.

Bridges consisting of timber platforms supported on floating vessels appear to have been in use in all ages. Those which were thrown by Darius across the Bosphorus, and subsequently over the Danube, and that which was formed by the order of Xerxes over the Hellespont at the time of his unsuccessful expedition into Europe, are the most famous works of that nature which were constructed by the ancients; and Herodotus has given (vii. 86) a full description of the last.

The precise period at which pontoons, or flat-bottomed vessels, were first employed to support a bridge is unknown. But mention is frequently made of pontoon bridges, both in Germany and Italy, in the beginning of the eighteenth century, particularly during the campaigns of Marlborough; and from the speed with which they are said to have been executed when required, it is probable that a corps of men was then particularly employed in that branch of the service. Pontoons, or flat-bottomed boats of wood, apparently similar to those of the preceding century, were employed on the Continent during the wars which arose from the first French Revolution.

General Sir Charles Pasley, to whom the department of military engineering in the British service is so much indebted for the improvements which he introduced into almost every branch of art connected with practical fortification and siege operations, constructed pontoons in the form of canoes, with decks, each end being shaped like the head of a boat. They consisted of light timber frames, covered, except the deck, with sheet copper; and each vessel was formed in two equal parts by transverse partitions, so that the demi-pontoons could be separated from each other when the bridge was to be conveyed on carriages by land with the army. When in the water, the parts were connected together by a rope, which passed through two perforations in the keel, near the place of junction, and by a rectangular frame of wood, which was laid along the deck and attached to it by lashings.

Sir James Colleton invented pontoons of wood of a cylindrical form, some of which have been occasionally employed in experimental operations; and cylindrical pontoons of tin, which were subsequently invented by General Blanshard, were introduced into the service. These last have hemispherical or conical ends. They possess the advantages of great lightness and buoyancy; but have not the durability of copper vessels, and are liable to be injured when transported by land, particularly if a march takes place under a hot sun. While, therefore, retaining their principle and shape, copper has in many instances been substituted for tin.

The diameter of one of General Blanshard's cylinders is 2 feet 6 inches, and its length 22 feet. A rectangular frame, rather greater in length than the breadth of the

intended bridge, is made fast by ropes, longitudinally, on the surface of each of two cylinders placed parallel to one another at about 10 feet asunder; and on these frames rest the baulks carrying the chesses or planks which form the road. Two pontoons, with their platform, constitute a raft; which, when the bridge is to be formed, are rowed to their stations in a line across the river, the lengths of the pontoons being parallel to the banks, and there anchored; the distances between the nearest pontoons in two rafts being equal to that between the two pontoons in each raft. Then each raft carrying the materials which are to make a platform over the water between itself and the next, such platform is laid down in a manner similar to that which is employed in laying down the platform of the raft; and from each of the extreme pontoons a like platform is extended to the shore of the river. Each pontoon requires 1½ minute to take its position, and when the pontoons are placed the roadway can be laid in 1½ minute for each interval between two pontoons. A river of 600 feet may thus be bridged in less than 1½ hour. In spite of its lightness and buoyancy, however, the Blanshard pontoon, from its liability to injury and its instability when immersed beyond the semi-diameter, has been superseded by an open barge, having decked ends and sides, invented by Colonel Blood, R.E. The Blood pontoon consists of six sets of framed ribs connected by a deep keelson, two side streaks and three bottom streaks. The sides and bottom are of thin yellow pine boards, covered on both sides with canvas, attached by india-rubber solution, and coated on the outer side with marine glue. These pontoons, which are 21 feet 6 inches long, have a displacement of 280 cubic feet, and are calculated to sustain a weight of 17,500 lbs. In the Indian army a smaller pontoon, having a bow and square stem, thus resembling the Blood pontoon, divided in the middle, is used.

The Berthon collapsible boat, which forms part of the equipment of the British army, is sometimes used as a pontoon for infantry in single file, and the engineers are also instructed in the building of pontoon bridges with casks and rafts of timber as well as by the methods indicated. In the war between Russia and Turkey in 1878-79, the Russians crossed the Danube by means of a pontoon bridge constructed with open boats of a pattern in use chiefly in the Austrian army.

PONTORMO. See PUNTORMO.

PONTRESINA, a small village in the Engadine, Switzerland, forming a favourite centre for tourists to the Bernina Alps, and of late years a favourite residence during the season from July to September. There are several excellent hotels and an English church. The altitude of the village is about 6000 feet. The glaciers around this mountain group are remarkably fine. Forests of larch and pine, overhanging the deep ravine of the Flatzbach, a tributary of the river Inn, add much to the picturesque beauty of the scenery in ascending from Pontresina to the Bernina Pass, by the road which leads from Switzerland to the Italian frontier town of Tirano.

PONTUS (Gr. *Pontos*), in Asia Minor, derived its name from the expression "on the Pontos Euxinos," i.e. on the Euxine Sea, or Black Sea, and was used rather as a political than a geographical term. Under Mithradates the Great it included the whole of Paphlagonia and part of Bithynia; but the name is usually applied to the country between Colchis and the river Halys, and is consequently bounded on the W. by Paphlagonia, on the S. by Cappadocia, and on the E. by Colchis. On the south Pontus is separated from Cappadocia by a lofty range of mountains called *Paryadres*. The north-eastern part of Pontus is exceedingly barren, and was inhabited by various barbarous tribes, of whom Xenophon has given some account in the "Anabasis." The western part of the country, which is very fertile, is well drained by the Iris (*Yeshlermak*) and

the *Thermodon* (*Thermeli*), and supplies good pasture for numerous flocks. Pontus was erected into a separate kingdom by Ariobarzanes I., 363 B.C. After the death of Mithradates VI. the greater part was annexed to the Roman province of Bithynia.

The chief towns on the coast, proceeding from east to west, were Trapezus (Trebizond), a colony of the Greek colony Sinope; Cerasus (Kheresoun), afterwards called Pharnacia, from Pharnaces, who was one of the kings of Pontus. Pharnacia is said to be the place from which L. Lucullus brought the cherry (*cerasus*) to Europe. In the interior the chief towns were Amasia (Amasieh), the birth-place of Strabo, and Comana.

PONTYPOOL, a market-town of England, in the county and 16 miles S.W. of Monmouth, and 167 from London by the Great Western Railway. It is situated on a steep cliff which overhangs the Avon Lwyd. The art of imitating Japan varnish, from which the articles varnished were called Japan ware, was discovered here, but is now extinct, and most of the inhabitants are employed in large coal and iron works near the town. There are two churches, dissenting chapels, a Baptist theological institution, and a town-hall. There is a good trade in iron and coal. The number of inhabitants in the town in 1881 was 5244.

PONY, the name given to many breeds of small active horses. [See HORSE.] They are found almost in a wild state in several mountainous regions, and though very vicious and strong, are easily trained to be of great service to man. They are very hardy, sure-footed, and invaluable for light, quick work. The varieties are too numerous to enumerate. Among the best known are the Shetland, Iceland, Galloway, Welsh, New Forest, Dartmoor, and Exmoor breeds, so called from their respective countries. Other races are found in Greece, Sardinia, and Corsica. The pony varies in size from a dog to a small horse, and is of different colour and appearance, according to the breed.

POODLE is a variety of Dog of German origin, well known by its thick, generally white curly hair, which almost entirely conceals its face and covers its body like a mat. The body is stout, the muzzle short, the ears drooping, and the tail rather short. This handsome pet is often rendered unsightly by its masters, who seek to give it a leonine appearance by closely shaving its hair, except at the tip of the tail and the head and shoulders. It is remarkably affectionate and intelligent, and can be taught to perform numerous tricks. The Barbet is a small variety of poodle, a well-known lady's pet, but bearing an ill character for temper.

POOLE, a municipal borough and seaport of England, in the county of Dorset, situated on the northern side of a considerable inlet, which forms the harbour, and opens into the bay, which extends between Hengistbury Head and Dorlstone Head, in the English Channel. Poole is 121 miles from London by the South-western Railway, and 18 miles east from Dorchester. The town is built on a peninsula on the north side of the harbour; the streets are irregular, but the houses are generally good, and some are of a superior class. The parish church has been rebuilt of Purbeck stone, and there is a chapel of ease. The Wesleyans, Independents, and Unitarians have also places of worship. There is a free grammar school among others. Poole Harbour has a very narrow entrance, but extends inland several miles, forming a large sheet of water when the tide is in, but an assemblage of mud-banks divided by narrow channels when the tide is out. Owing to its peculiar geographical position, the tide here ebbs and flows twice in the twelve hours. The harbour is safe, and contains good quays and wharfs, and there is a good coasting and colonial trade. The approach has been widened and deepened, and large vessels can reach the quays at high water. The chief exports are sailcloth and cordage—manufactured in the town—and Purbeck clay for the Staffordshire potteries.

The quantity of the latter shipped annually is about 60,000 tons. Coal is the principal article imported.

The municipality consists of six aldermen and eighteen councillors, the mayor included. The name is said to be derived from Cynric *pool*, a lagoon. It was not a place of much consequence until the reign of Edward III., when it furnished four ships for the siege of Calais. Leland attributes its rise to the decay of the neighbouring port of Wareham. This becoming choked up with sand, the merchants migrated to Poole, which had previously been a collection of fishermen's huts. It was much frequented by Spanish ships until the war with Spain, in the reign of Elizabeth, when its trade fell off considerably; but the town afterwards recovered itself. It had a small fortification, which was held by the Parliamentarians in the Civil War, and was dismantled by Charles II. after the Restoration. Poole was a parliamentary borough until 1885, when it was merged in the county. The population in 1881 was 12,310.

POO'NA (*Puna*), the military capital of the Deccan, and from July to November the seat of the Government of Bombay, British India. It is a station on the Great Indian Peninsula Railway, 119 miles south-east of Bombay. It is situated on the right bank of the Muta River, 1850 feet above the level of the sea, and, in a straight line, about 63 miles distant from the coast. The population is about 95,000. Much of the country round is barren and rocky, and to the east stretches an open plain. But to the north and west, blocks of low flat-topped hillocks, and, to the south, the line of hills that on the west ends in the bolder outline of the Sinhgarh fort, relieve the monotony of the scene. Close at hand, on the north, the confluence of the streams of the Muta and Mula; through the heart of the town, the line of the Kharakwasla Canal; and on the south, the lake and solitary peak of Parvati, are objects of interest. Gardens on every side, and thickets of acacia along the banks of the rivers, give much of the neighbourhood a green, well-clothed appearance. The city extends along the Muta for about $1\frac{1}{2}$ mile inland, varying in height from 30 to 70 feet above the river. Its length is about 2 miles from east to west, and its breadth about $1\frac{1}{2}$ mile. The chief streets run north and south. Though broad in parts, they are all more or less crooked, none of them offering an easy carriage way from one end of the town to the other. Most of the houses are of more than one storey, their walls built of a framework of wood filled in with brick or mud, and with roofs of tile. A few residences of the old gentry are still maintained in good order, but the greater number are in disrepair or ruin. Within many of the blocks of buildings that line the streets are large courtyards, entered by a doorway, and crowded all round with the huts and hovels of the poorer classes. Towards the north of the town is the military cantonment, with a population of 9600. Within cantonment limits, northwards to the Muta-Mula River, and for 2 miles along the road leading west to the cantonment of Kirkee (Khadki), are the residences of the greater part of the European population. Though Poona is no longer so great a centre of trade and industry as it was under the Peshwas, Poona workers have earned a reputation for the manufacture of silver and gold jewelry, combs, dice, and other small articles of ivory; of fans, baskets, and trays of *khaskhas* grass ornamented with peacocks' feathers and beetles' wings; and of small carefully dressed clay figures representing the natives of India. As a civil station, Poona is the residence of the usual district officers, and it is also the headquarters of the survey, revenue, and police commissioners of the southern division of the Presidency. As a military station, it is the headquarters of a general of division, of the quarter-master-general and adjutant-general of the Bombay army, and a military force which generally consists of European and Native infantry, artillery, and cavalry. Be-

sides a female normal school, a training college for preparing teachers for vernacular and Anglo-vernacular schools, and several government and private vernacular, Anglo-vernacular, and English schools, the city of Poona has a government first-grade high school, and two colleges—the

are the Legislative Council Hall, the Sassoon Hospital, Jewish synagogue, military pay offices, barracks, &c. With the heat of April and May tempered by a sea-breeze, a moderate rainfall, and strong cool winds, the climate is agreeable and healthy.

The cave-temple of Carlee is about a mile from Carlee, which is the last village on the great road across the Western Ghats from Bombay to Poona. The temple is hewn in the face of a rocky precipice, two-thirds up the side of a steep hill, which is about 800 feet above the plain, and is approached by a narrow path winding up the side of the hill among trees and brushwood and fragments of rock. Besides the principal temple, there are many smaller apartments and galleries, in two storeys, some of them beautifully ornamented. The approach to the temple is under a noble arch filled up with a sort of portico screen, in two storeys of three intercolumniations below and five above. Within the portico, to the right and left, are three colossal sculptures of elephants, in alto-relievo, with their heads, tusks, and trunks projecting boldly from the wall. On each of them is a driver, very well carved, and a palanquin, with two persons seated in it. The internal screen of the vestibule leading to the temple is covered with alt-relievi of male and female figures, somewhat larger than life. The temple itself is about 60 feet long by 30 wide, surrounded on every side but that of the entrance with a colonnade of octagonal columns, the capitals of which consist of a large cap like a bell, finely carved, and surmounted by two elephants with their trunks entwined, and each carrying two male figures and one female. The roof is decorated with ribs of timber, which are not for support, but have a fine effect in the perspective of the interior. There is no image of Buddha or any other idol in this temple.

POONG'YE or **POOG'YE** (or *Poon'gi*), a curious Hindu wind-instrument, also called *tumri* and *magudi*. It consists of a caddis-nut or of a gourd, hollowed out: into this two pipes are inserted, and fixed by black wax, giving it somewhat the look of a bagpipe. The gourd, in specimens in the South Kensington Museum, measures $4\frac{1}{2}$ inches across, and the whole instrument stands 1 foot 5 inches high. A horn mouth-piece is seen in some specimens. Inside the gourd are two reeds, one for each pipe, made after a simple fashion, such as boys still use when they make a lateral incision in a fresh oat-straw. The performer blows into the gourd by a short tube, and plays upon holes in the chanter-pipes; the other pipe serves as a drone. About nine notes are producible; the tone is plaintive and weak, capable of considerable expression. It is the chosen instrument of the snake charmers, who use no other; and is a favourite with all acrobats and public performers among the Hindus.

One variety is blown by the nose, and this is the *tumri* proper. The use of the nose-blowing is to prevent the loss of caste which would be suffered by a person of high caste if he touched with his mouth that which had been touched by the mouth of one of inferior caste.

It is beyond doubt that the tones of the poongye have a remarkable effect upon snakes, even the venomous cobra di capella. Colonel Meadows Taylor (*Proceedings Royal Irish Academy*, 1865) gives a detailed account. The cobras that he saw rose on their tails to the music, expanded their terrible hoods, and waved to and fro, faster and faster as the music increased in rapidity. A very

large cobra, long the terror of the colonel's garden at Ellichpore, was enticed from his hole by the sound of the pongye, and captured in a blanket by a companion of the player while absorbed in listening; his fangs were drawn, and he was carried away quite tame to be trained for exhibition. Many other particulars relating to similar occurrences are given by this most trustworthy witness, so that the fact is amply proved. Besides, it is familiar to all travelled Anglo-Indians.

POOP (Lat. *puppis*), the highest and aftermost part of a ship's deck, or a partial deck extending close aft above the complete deck.

POOR LAWS and PAUPERISM. The term pauper in England is used to designate a person who, being unable to secure a maintenance, becomes dependent upon the community, and is supported wholly or in part out of certain taxes levied solely for this purpose. No man who gets his living by his labour and receives no legal relief, can be called a pauper, however poor he may be; nor can the term be applied to those who are supported wholly or in part by the voluntary gifts of relatives or charitable persons.

The existence of large numbers of persons unable to support themselves may be found in connection with nearly every civilized society, both in ancient and modern times. Human life, like that of the lower animal and vegetable kingdoms, represents a struggle for existence, and though the severity of the conflict is greatly mitigated by civilization, it is not wholly removed, and hence some of the weaker are being continually thrust aside and rendered dependent. In all communities we find poor widows with children whom they cannot maintain without assistance, and there are orphans whose friends are too indigent to support them, men enfeebled by disease and injury, and aged people incapacitated by their very age from doing anything to earn a livelihood, who must more or less fall to be provided for at the public charge. In nations which have only entered the early stages of civilization, and among those in which almsgiving forms a considerable part of the national religion, the care of the poor is left to the natural feeling of the people; but with the growth and development of government it commonly happens that the spontaneous charity of the community becomes regulated by some recognized organization, or is supplemented by legislative enactment. Thus, among the ancient Jews the care of the poor was not only steadily inculcated as a duty due to Jehovah, but it was also supported by numerous injunctions in the legislation of the Pentateuch. It is expressly asserted in Deut. xv. 11, that "the poor shall never cease out of the land," and in accordance with this declaration, the right of gleaning, of a share in the tithes, to the unknown growth of the sabbatical years, of manumission after certain fixed periods of servitude, and a free admission to certain of the annual feasts, are secured to them for their support. It is probable that many of the provisions of the law for the benefit of the poor were never carried into actual practice, but they serve to show the general kindly spirit of the Jewish legislators towards them.

Among the Greeks, although certain writers speak of a primitive period when none were in want and beggary was unknown, a provision for the poor and for wounded soldiers, and the widows and orphans of those who fell in battle, was early adopted as a matter of state policy. In addition to this, the Greeks appear to have adopted to some extent the principle of insurance, and to have maintained numerous mutual friendly societies or clubs, termed *Eranoi*, the distressed members of which were relieved and assisted by the rest. Like the Jewish legislation, that of the Romans contained many provisions designed to guard against the extremes of wealth and poverty, for an account of which see under **AGRARIAN LAWS**. About 123 B.C. **CAIUS GRACCHUS** introduced a poor law by which a

monthly distribution of corn was made to the people at an almost nominal price, a measure which attracted a large number of needy citizens to the capital, and exerted a most injurious effect upon the nation, but which lasted till the fall of the empire.

In Europe, during the first centuries of the mediæval period, the great body of the peasantry and of the labouring classes were in bondage to the feudal lords, and while, on the one hand, they had to contribute towards the support of the lord by their labour, they had a claim upon his bounty when they became helpless. As the old ties became relaxed, the change to freedom produced many poor and masterless men, and vagabondage with all its attendant evils became very common. In England, the great object of the earlier efforts in pauper legislation was the restraint of vagrancy, as appears from the celebrated Act of 12 Richard II. c. 7 (1388), in which a distinction is made between the helpless poor and beggars able to work, the former being committed either to the care of the people among whom they dwelt at the time of the passing of the Act, or those of the hundred, rape, wapentake, or town where they were born. Other laws for the suppression of vagrancy are to be found in the 11 and 19 of Henry VII. (1495 and 1504), and the 22 Henry VIII., c. 12 (1531), but these seem to have had no permanent effect. If we may judge from the severity of the last of these laws, with its penalties of imprisonment, the stocks, and of whipping, the evil must have assumed considerable dimensions; but like those which had preceded it, the Act proved inadequate to abate the mischief. In dealing with sturdy beggars the law had omitted to provide for the aged and impotent poor, and another Act was passed in 1586 (27 Henry VIII., c. 25) by which, for the first time, an authorized machinery was established for the collection and distribution of funds contributed for the relief of the poor. It enacts that the head officers of every parish to which the impotent or able-bodied poor may resort, under the provisions of the Act of 1531, shall receive and keep them, so that none shall be compelled to beg openly. The able-bodied were to be kept to constant labour, and every parish making default was to forfeit 20s. a month. The money required for the purposes of this Act was to be derived from voluntary contributions, collected partly by the head officers of corporate towns and the churchwardens of parishes, and partly in the churches and on various occasions where the clergy had opportunities for exhorting the people to charity. Certain of the poor people were themselves to be appointed to collect and gather broken meats, &c., from every householder in the parish, to be distributed equally among the poor. Provision was made in the Act for the punishment of embezzlement of the funds contributed for the poor, and also for the remuneration of the constables, churchwardens, and collectors of alms employed in their collection and distribution. This voluntary system does not appear to have been very effectual, and after the suppression of the monasteries the evils attendant upon vagabondage were greatly intensified. Crowds of idle and destitute persons infested the country, many of whom resorted to theft and robbery as well as beggary, and some laws of terrible severity were enacted for their suppression. Of men of this class, described as "great thieves, petty thieves, and rogues," many thousands were hanged during the reign of Henry VIII., while the penalties imposed upon those who were merely sturdy beggars, were whipping for the first offence, branding for the second, and death without benefit of clergy for the third. The severity of the law, however, was not sustained by public opinion, and the 1 Edward VI., c. 8 (1547) after deploring the fact that the salutary provisions of the law had "through foolish pity been rendered of none effect," substituted the milder penalties of branding and slavery. This statute was enlarged by the 8 & 4 Edward VI., c. 16, by which any person was authorized to take the

child of a beggar between the age of five and fourteen in order to bring it up to honest labour, whether the parents consented or not; and two years later a law was passed to compel the appointment of two persons in every parish to act as collectors for the poor, and which made provision for the ecclesiastical censure of those who refused to contribute. The principle of compulsory taxation for the support of the poor was not accepted at this period, but after some intermediate legislative experiments had been tried and had failed, it was adopted (though to a very limited extent) by the 5 Elizabeth, c. 3, passed in 1563. This principle was brought into full operation a few years afterwards (1572) by the 14 Elizabeth, c. 5, which, after providing for the imprisoning, whipping, branding, and stocking of sturdy rogues and vagabonds, declared that poor, aged, and impotent persons should be supported by the towns and parishes, and gave the power of compulsory assessment to the justices for the latter purpose. This important statute was subsequently enlarged and amended in 1576, 1580, and 1597, and it formed the basis of the celebrated Act of 1601 (43 Elizabeth, c. 2), which has remained as the foundation of pauper legislation up to the present day. In its original provisions the Act directed the overseers of the poor in every parish to take order for setting to work the children of all such parents as shall not be thought able to maintain their children, as well as all such persons as, having no means to maintain them, use no ordinary trade to get their living by. For this purpose they were empowered "to raise, weekly or otherwise, by taxation of every inhabitant, parson, vicar, and other, and of every occupier of lands, houses, tithes, mines, &c., such sums of money as they shall require for providing a sufficient stock of flax, hemp, wool, and other ware or stuff to set the poor on work, and also competent sums for relief of lame, blind, old, and impotent persons, and for putting out children as apprentices." The churchwardens and overseers were further empowered to build poorhouses, at the charge of the parish, for the reception of the impotent poor only. The justices were further empowered to assess all persons of sufficient ability for the relief and maintenance of their children, grandchildren, and parents. The parish officers were also empowered to bind as apprentices any children who should be chargeable to the parish.

The provisions of this Act seem to have come into operation very slowly, and they were subsequently modified and amended by certain Acts passed in the reigns of James I. and Charles I., during the Commonwealth, and after the Restoration, the most important being that of 13 & 14 Charles II., c. 12, which gave power to justices of the peace to remove poor persons who came into the parish back to the parish from which they came, provided this was done within forty days of their arrival. In this way the law of settlement arose, which was to form such an important element in the poor law of the subsequent period. In 1722 the system of outdoor relief was set aside by 9 George I., c. 7, which introduced the workhouse system. All who refused to be lodged in the workhouse were to be refused relief, and small parishes were allowed to unite or contract with others for the maintenance of the poor. As a result of this Act a great increase in the number of workhouses took place, but it had the effect of checking pauperism, inasmuch as the workhouse test was strongly resented by the poor. The harshness of this Act was increased by the incapacity, negligence, and misconduct of the overseers, and this led, in 1782, to the passing of Gilbert's Act, by which guardians were appointed to protect the poor, workhouse unions were introduced, and provision was made for the more economical expenditure of the money raised. In 1795 a very important alteration in the poor laws was made by the 36 George III., c. 23, which repealed the Act forbidding relief to those who refused the workhouse, and permitted the bestowal of outdoor relief,

not only in cases of temporary illness and distress, but also in aid of inadequate wages. Designed to mitigate the hardships of the poor and to remove some real evils inherent in the previous methods of administration, the new Act proved most disastrous to the well-being of the country. Very soon after it had passed outdoor relief became the rule, and the poor laws became a mode of paying wages in most of the agricultural districts. The amount expended in the relief of the poor in the year 1790 was £2,567,000, or 5s. 11d. per head of the population; in 1800 the amount had risen to £3,861,000, or 8s. 6d. per head of the population; and from this point it advanced, until in the year 1818 the sum expended was £7,890,000, or 13s. 4d. per head of the population of England and Wales. Owing to a decline in the prices of the necessaries of life, the actual amount expended declined somewhat from this point during the next ten years, but the evils attendant upon the system became so intolerable and so widely recognized as to prepare the way for the trenchant reforms of 1834. In 1832 a commission was appointed by Parliament "to make diligent and full inquiry into the practical operation of the laws for the relief of the poor in England and Wales, and into the manner in which those laws were administered, and to report their opinion as to what beneficial alterations could be made." The results of this inquiry were laid before Parliament in 1834, and the report showed that the evils to be dealt with were of the most serious character, affecting not only the poor, but extending also to all classes of society. Those evils were due for the most part to the various expedients for affording outdoor relief to the able-bodied labourers, a class never intended by the legislature to be the objects of relief. The report classified those expedients as follows:—(1) Relief without labour; (2) the allowance system; (3) the roundsman system; (4) parish employment; and (5) the labour-rate system. Of these methods the most universal and perhaps the most pernicious was the allowance system, of which the essential feature was the allowance to labourers of relief in aid of their wages. In its administration, the magistrates in a county or district would fix what the income of a labourer should be in money, or the price of so much bread, and upon the income so fixed every man could count with confidence. If he were unable to obtain work he could claim the whole of such income; in partial work he could claim the sum by which the amount he had earned fell short of that income; and, further, the amount given was increased according to the size of the applicant's family. The roundsman system was that the parish paid occupiers of property to employ paupers at a certain rate of wages, in the general way making an agreement with a farmer to sell to him the labour of one or more paupers at a certain price, paying to each pauper out of the parish funds the difference between that price and the amount awarded by the established scale. Parish employment was but little used, as the method afforded no direct profit to any individual, the labourers could not be properly looked after, and they were invariably lazy and unwilling to do more than they were obliged. The labour-rate system was that by which the ratepayers agreed that each one should employ a certain number of the labourers settled in the parish, the number being regulated in accordance with each man's rental, contribution to the rates, or the number of acres he occupied. Those who could not employ any of the labourers were required to contribute a larger money payment.

Whichever method was employed, however, the results of the poor laws were found to be the wholesale demoralization of the labourers and the impoverishment of the rest of the community, owing to the continuous increase of the rates. In many parishes the whole of the labourers were paupers, and these were obtaining more for idle and indifferent service than could be obtained by hard and honest

labour, while they found their allowances increased if they took pauper wives, and still further raised by the birth of pauper children. The disgrace of being "a parish bird" had almost passed away, relief being regarded as a right to be enforced, if necessary, through the magistrates. Relying upon parish support, the labourers were indifferent as to obeying their employers, and they became indolent, impudent, and dishonest, while in many cases domestic affection fell so low that "mothers and children would not nurse each other during sickness unless the parish paid them for it." A further evil was found in the circumstance that where independent labourers had to compete with paupers, the former were placed at the most serious disadvantage. Thus, if a respectable man were known to have saved a little money employment would be refused him because it afforded no saving to the rates, whereas it would be given to a penniless man, because otherwise he would come upon the parish. Consequently the labourers were accustomed not only to avoid accumulation, but when they came in for any property it was rapidly spent, so that they might become entitled to wages or relief. Married men were also employed in preference to single by the farmers for similar reasons, for while the parish was only saved 3s. or 4s. a week in the case of a single man, it was saved from two to four times that amount when a married man with a family was employed and kept off the rates. In consequence many labourers married at seventeen or eighteen in order to qualify themselves either for work or relief. The testimony collected by the commissioners respecting the degradation of the pauperized labourers was abundant and overwhelming, and in their report they declared that "the severest sufferers are those for whose benefit the system is supposed to have been introduced and to be perpetuated, the labourers and their families." At the same time the injury inflicted upon other classes was very severe, for the increase of the rates had in many instances become absolutely ruinous. Rents were being reduced to half or less than half what they had previously been; and 5s. an acre for good land was a common rental, because £1 per acre was a common poor-rate. Farms were being constantly thrown up by the tenants because they could not stand the increased rate; and while the value of land was thus falling, the population in the same districts was increasing.

The report of the commissioners was presented in February, 1834, and was followed by the passing in August, 1834, of the Poor-law Amendment Act, 4 & 5 William IV., c. 76, in which their principal recommendations were embodied, and though this Act has been subsequently amended by various statutes, its main provisions are still in force.

Under the Act three commissioners were appointed, styled the "Poor-law Commissioners for England and Wales," sitting as a board and appointing assistant commissioners and other officers. The administration of relief, according to the existing laws, was subject to their direction and control, and to their orders and regulations for the government of workhouses and the guidance and control of guardians and vestries, and the keeping and allowing of accounts and contracts without interfering with ordinary relief in individual cases. In order to introduce the provisions of the law as quickly as possible, the whole of England and Wales was divided into districts, to each of which an assistant commissioner was appointed, and in a short time about 660 poor-law unions, each under the management of a board of guardians, had taken the place of 15,000 separate jurisdictions which up to that time had independently maintained their poor. The Act made no change in the law respecting the ratability of property or the mode of collecting the rate, and only took up the latter after it had been collected for the purpose of securing its better distribution. It was based, in common with the earlier Acts, upon the principle that no one should be suf-

fered to perish for want of the necessities of life, but the manner of administering relief was regulated by subjecting the applicant for it to the discipline of a workhouse and to other restraints, in order that the condition of a pauper, living upon the parish fund, should be depressed in point of comfort below that of the ordinary labourer who maintained himself by his own exertions. Thus a ready test was applied to distinguish real and pretended destitution, and a powerful incentive to work was held out to all who could find employment. It was found impossible, in practice, to withdraw outdoor relief altogether, as the commissioners had recommended in their report, but the Act sought to limit it to poor persons wholly unable to work from age or infirmity. As might be expected changes of such important character were not introduced without some resistance on the part of the pauperized labourers, and also on the part of many who regarded the new law as harsh and unkind; but the relief experienced throughout the country was so great that the commissioners were supported by Parliament and allowed to complete their work, with the result that the rates, which in 1834 had amounted to £6,817,255, were reduced in 1837 to £4,044,741. By numerous Acts of Parliament passed subsequent to the Amendment Act of 1834, the administration of relief has been affected in various ways, but the most important change was that which was effected by the 34 and 35 Vict., c. 70, when the LOCAL GOVERNMENT BOARD was established, and to it was transferred all the powers and duties of the Poor Law Board.

As the law is at present constituted the administration of relief to the poor is intrusted to the control of the board, who make rules and regulations for the purpose, which are binding upon all the local bodies. They are empowered to order workhouses to be built, hired, altered, or enlarged, with the consent of the majority of a board of guardians. Parishes or unions are managed by boards of guardians, the majority of whom are annually elected by the rate-payers of the various parishes, but a certain number of members are now nominated by the Local Government Board. These guardians appoint the masters of the workhouses and their officials—subject, however, to the approval of the Local Government Board. The expenditure for every purpose is very strictly guarded, and examined by public auditors, of whom there are about fifty in England.

The overseers are responsible for collecting the poor-rate from the persons rated. If a person does not pay when called upon the overseers may obtain a summons from two justices, requiring him to show cause why a warrant should not issue to levy the rate by distress and sale of his goods; and if no sufficient cause is shown, the payment is enforced accordingly. The party so summoned may show for cause that the rate itself is void, or that he is not liable; he may also, with the consent of the overseers or board of guardians, be excused, if it appear that he is too poor to pay.

The overseers have to supply the funds required by the boards of guardians for the relief of the poor, and cannot now, as formerly, administer it themselves. The poor of the parish are, in one sense, all those who happen to be in the parish at the time of their being in a state to need relief. But if the same parish were bound also to afford continued relief to, or permanently to maintain, all the destitute who should come within it, the burden of supporting the poor might press very unequally upon different parishes. The 13 & 14 Car. II. c. 12 was passed to obviate these evils, and is the foundation of the present law, which determines the parish that a pauper belongs to, and gives the power of removing him to it; but restrictions have been placed upon this power, for the benefit of the pauper, by the 9 & 10 Vict. c. 66. This law is called the Law of Settlement. By the Act 29 & 30 Vict. c. 113, termed the Poor-law Amendment Act, 1866, one year's unbroken residence in a parish extinguishes liability to removal.

All persons, whether natural-born subjects of England and Wales, Scotchmen, Irishmen, or foreigners, may gain a settlement in this country. Paupers who have no settlement must be maintained by the parish in which they happen to be, as casual poor, unless they were born in Scotland or Ireland, or in the islands of Man, Jersey, or Guernsey, in which case they are to be taken under a pass-warrant of two justices to their own country. When a pauper has become chargeable, and it is sought to remove him, he is taken before two justices, who, if satisfied, make an order for his removal. The parish to which he is removed may dispute its liability by appeal to the quarter sessions.

The relief of the poor, the greatest and oldest branch of what is now a vast system of local administration, affords considerable ground for encouragement, whether we regard the mode of its administration or the number and character of its recipients. The total amount of money expended in the relief of the poor during the twelve years prior to the passing of the Poor-law Amendment Act of 1834 amounted to about £76,096,000, and during the twelve subsequent years the total amount only reached about £57,247,000. The amount expended in 1834 was £6,317,255, and in 1884 it was £8,402,553; and though the latter amount shows a considerable increase, the growth of the charge has fallen far short of the development of the population. In 1882, the year of the appointment of the Poor-law Commission, the cost per head of the population was 9s. 9d., while for the year ended Lady Day, 1884, it was only 6s. 3½d., a decrease of 83 per cent. The amount of pauperism has of course varied in the interval, and it still fluctuates to a certain extent with the general commercial activity of the country, but the last few years have shown a steady decline. In 1869, 1870, and 1871 the total number of paupers exceeded 1,000,000; but in 1872 the tide turned, and the number fell steadily until, in 1878, it was brought down to 742,700. Unhappily it then began to rise again, and after attaining a much higher figure it amounted to 788,902 in 1885. Of this total, adult able-bodied pauperism forms but a small proportion. In 1883 the mean number of adult able-bodied paupers was—in-door, 21,558; outdoor, 77,592; total, 99,150, excluding vagrants. Such a number appears by no means unmanageable when compared with the general mass of the population, and every effort is made to keep down the number.

Guardians have become generally alive to the fact that it is here that they can most effectively reduce their burden, and they are applying at once more intelligently and kindly the principles laid down by the commissioners of 1834—viz. of offering the workhouse only to the large majority of paupers. Those principles were somewhat coldly and rigidly expressed, but they embodied the true method of poor-law administration, and are invaluable as general rules. It must never be forgotten that in all societies there are many to be found who are anxious to avoid labour, and at the same time to live at ease; nor can we find any community so poor as not to suffer in some degree from the existence of idle and worthless persons subsisting on the benevolence, or folly, or fears of its members. Such persons, while very ready to accept alms or relief in money or goods, shrink from the restraint and discipline of the workhouse, and it has been found again and again that judicious strictness in bestowing outdoor relief is the truest kindness, inasmuch as it drives back the idle and improvident into the ranks of labour. In a recent year there was a decrease in the amount expended of £315,000, and of this £304,449 was saved in outdoor relief, the in-maintenance being increased only by £33,613. Of course some part of the diminution must be ascribed to the more ample employment available to the poor during the period indicated. It has been found in connection with the relief of the poor that great variations are to be found in the numbers

of those who adopt a wandering life. In 1869 the number of vagrants relieved in all England was 7020; in 1878 the number had fallen to 2700; in 1881 it had risen to 6979; but the following year the Casual Poor Act, extending the periods for which vagrants may be detained in casual wards, came into operation, and in 1883 the number had fallen to 4790. These fluctuations are somewhat remarkable, but it must be noted that when a decline takes place it cannot arise from the people becoming vagrants elsewhere, for the returns are comprehensive. They simply discovered that their old life had ceased to be worth pursuing, and betook themselves to some other occupation. Similar lessons are taught by the remarkable changes produced by increased individual attention to the administration of relief. With no other aid, for instance, than searching inquiry into individual cases, the guardians in the Brixworth Union in two years reduced the number of paupers on their lists from 1090 to 609.

It is when poor relief is allowed to lapse into a mere system that it becomes at once unduly burdensome to the ratepayers and demoralizing to the recipients. Personal labour and care are the essential conditions of its healthy administration, and one of the most encouraging features of recent years is the voluntary efforts which are now placed at the disposal of the officers of the poor law. Even official work is ceasing to have the mere official character which once characterized it.

The following is the number of paupers (exclusive of vagrants) in receipt of relief in the several unions and parishes under boards of guardians in England and Wales, on the 1st of January in each year.

Years.	Number of Unions and Parishes.	Indoor.	Outdoor.	Total.
1860	646	119,026	731,994	851,020
1865	655	188,119	833,314	971,433
1870	649	165,324	913,905	1,079,229
1880	649	189,384	648,636	837,940
1886	647	194,446	618,193	807,639

In conclusion, it may be observed that considerable difference of opinion exists among economists as to the soundness of the principle by which the support of the poor is recognized as a duty to be enforced and regulated by the power of the state. It has been pointed out by some opponents of this principle that population has an indefinite elasticity, and that it is nearly everywhere pressing upon the available means of support. Anything, therefore, which tends to place the responsibility for the maintenance of the imprudent and careless upon those who have displayed the opposite qualities of forethought and self-restraint, increases the evil, by making the struggle for existence more difficult for the latter. It is a fact too well established to be questioned that indiscriminate almsgiving maintains beggary as a permanent institution, and it has also been maintained that the state support of paupers serves to increase pauperism. As one economist of this school has observed, "You may have as many paupers as you like to pay for," and others have pointed out that the poor-law system must be held responsible for some of the misery it professes to remedy. Some interesting arguments in support of the latter theory are to be found in the late Professor Fawcett's work, "Pauperism: Its Causes and Remedies," published in 1871, the substance of which was also embodied in the subsequent editions of his "Manual of Political Economy." At the same time it must be observed that Fawcett admitted the practical necessity for a poor law, and his criticisms were directed towards the amendment of the existing system rather than towards its abolition. On the Continent the principle of the compulsory support of the poor by a special tax is

dreaded on account of the socialist principle it involves, and from the fear that the discontented members of the lower classes, or workmen at a time of commercial conflict, might disorganize society by a wholesale reliance upon the rates for support. On the other hand, dealing with things as they are, it must be admitted that the poor-law system prevailing in Great Britain does much to mitigate the severity of the struggles so often waged between capital and labour. The dread of absolute starvation being removed, men are less fierce in their demands than are their fellows in those countries where there is no such protection. Nor can it be denied that where the poor law is fairly and honestly worked, it mitigates and relieves a vast amount of misery at once more effectively and more cautiously than is possible to unaided private effort. Most of the evils attendant upon the present system spring from a lax administration of outdoor relief, but after the experience of the first thirty years of the present century it is hardly probable that this will be allowed to exceed due bounds.

POOR LAWS, IRELAND.—Until the passing of the Act 1 & 2 Vict. c. 56, which received the royal assent on the 31st of July, 1838, no provision had been made by law for the relief of the helpless or the destitute in Ireland, except by means of county infirmaries and other medical charities established by law. Under that Act and the 10 & 11 Vict. c. 31, destitute poor are relieved in work-houses, and outdoor relief may be afforded under certain circumstances. These statutes also enable the guardians to assist poor persons to emigrate. At first the superintendence of the Irish poor law was entrusted to the Poor Law Commissioners for England and Wales, but was subsequently transferred to a separate commission appointed exclusively for Ireland.

In Ireland, in 1886, there were 108,516 persons in receipt of parochial relief, the total amount expended for which was £1,259,610.

POOR LAWS, SCOTLAND.—From a very early period the legislature made provisions for the punishment of the idle poor, e.g. 1424, c. 42; 1535, c. 22; 1579, c. 74—all of which were ratified by 1698, c. 21. Of these, however, the most important was that of 1579, c. 74, which in many respects resembled the celebrated English statute of the 14th of Elizabeth, passed a few years earlier. It did not provide, however, for the relief of the able-bodied who were destitute; and a settlement under it which was acquired by birth could not be changed but by a seven years' industrial residence elsewhere. This period of industrial residence was in 1672 shortened to three years, and till within a very recent period, owing in part to the small number of the poor, and the necessary relief involving only a very trifling assessment, and partly to the fact of the charity of the church-going public being devoted to that relief, niggardly as it was, the Scottish system was very favourably received, not only by the great body of the landowners and clergy in Scotland, but by political economists, who saw the country in an apparently sound moral condition, with a parsimonious poor law, while the lavish system of England seemed to promote profligacy and idleness. But during the time that had elapsed up to the completion of the great change of the English poor law, a vast internal alteration had taken place in the social economy of Scotland. The comparatively low rate of wages, attracting manufacturing capital from England, had caused a more than average migration of rural labourers to the manufacturing districts, and a peculiarly rapid increase of the town population. It was then found that the simple parochial system, adapted to a very different state of society, was altogether incapable of grappling with the complicated rights and obligations of the different parishes, and that even for poor country districts the system was unsuitable, since the town administrators of relief, though still far behind the English in profusion, were compelled by

the voice of public opinion to become more liberal in their dispensations, while the managers of the country parishes, not subject to the same influence, kept down the allowances, and thus gave the poor every inducement to seek, and if possible obtain, a legal settlement by three years' industrial residence in the towns.

It was soon discovered that the utter inadequacy of the provision afforded to those who, by inability to work, or bad seasons, or revulsions in trade, were reduced to want, was an extensive cause of disease, vice, and misery. The amount expended on the relief of the poor in Scotland amounted to little more than a sixth part of the sum distributed throughout an equal population in England, even by the then economized poor law. In England the expense amounted to 6s. 10 $\frac{1}{2}$ d. per head; in Scotland to 1s. 2 $\frac{1}{2}$ d. In some instances sums averaging from 3s. to 1s. monthly were solemnly awarded to the destitute people, as the provision which the poor law made for their wants. The discussion of these matters, however, had a tendency gradually to increase the amount of the provision for the poor, and during the later years of the system the amount raised by assessment was considerably increased.

In 1845 an Act was passed which made considerable alterations in the Scotch system, and under which the grievous distress which sometimes prevailed under the old plan has been to a great extent alleviated, although, perhaps, at some sacrifice of that feeling of sturdy self-reliance and independence which is a chief characteristic of the Scotch even of the most humble classes. By this Act (8 & 9 Vict. c. 83, as amended by 24 & 25 Vict. c. 18) the relief of the poor is now administered. A Board of Supervision is appointed, of persons connected with the municipal bodies and the administration of justice in Scotland, with one salaried member, who gives constant personal attendance. The office of the board is in Edinburgh. This board is endowed with ample means for ascertaining, in all parts of the country, the condition of the poor, and the method in which the system of relief is administered. The board has, however, no directory or prohibitory control over the proceedings of the local boards, though these bodies are recognized by the Act. In the rural parishes where there is an assessment, the local board consists of proprietors of property of £20 annual value, the kirk session, and certain elected representatives of the other ratepayers, according to the number fixed by the Board of Supervision. In city parishes the boards each consist of four persons named by the magistrates, deputies not exceeding four from each kirk session in the city, and certain elected persons, according to a number and qualification fixed by the Board of Supervision. When persons apply for relief, it is provided that though they have no settlement, if the claim would be just in the case of their having one in the parish where it is made, subsistence must be afforded them till it is determined what parish is liable. When relief is refused, the applicant may apply to the sheriff, who may grant an order for temporary relief, and then hear parties, and decide whether the applicant is or is not entitled to relief. In this form, however, neither the sheriff nor any other judge can decide on the adequacy of relief. The initial step to any judicial appeal against the amount of the relief is afforded by an application to the Board of Supervision, and on that body reporting its concurrence, the applicant is placed on the poor-roll of the Court of Session, where he has the privilege of the question being discussed gratis. By this Act provision was made for medical attendance and medicines being part of the system of pauper relief, and for the education of pauper children. It was also provided that, for the purposes of the Act, parishes might be united into "combinations." By a special clause nothing in the Act was to be construed as entitling the able-bodied to relief, and their claim was thus left in the state of doubt in which it stood before the

passing of the Act; but it has since been decided in the House of Lords that no part of the assessed fund can be so applied, consequently all claimants must be aged, infirm, or disabled. Men deserting their wives and children, who thereby become chargeable to a parish, were made liable to punishment as vagrants. The time necessary to acquire an industrial settlement was increased from three to five years. Outdoor relief is the rule in Scotland—there being only about forty workhouses in the whole country. The mode of assessment of the poor rate differs somewhat from that of England, as in most cases one-half the amount is paid by the owners and the other half by the occupiers, whereas in England all is paid either by the occupier or owner. In 1871 a select committee of the House of Commons recommended sundry alterations in the constitution of the parochial boards, by which the poor-law system of Scotland would in some respects be more nearly assimilated to that of England.

In Scotland the number of registered paupers and their dependants (exclusive of casual poor) in receipt of parochial relief in 1886 was 91,100; and the sum expended was £871,511. In connection with these figures it should be mentioned that of the 91,100 persons relieved, 25,936 were natives of Ireland.

In the United States the poor-law system in its general features is similar to that which prevails in England as far as regards the mode of raising the fund and the class of people to whom relief is afforded. Each district (commonly a town, county, or city) provides for its own poor. The prevailing practice is to give outdoor relief to the impotent poor, and the workhouses are regarded rather as penal institutions than as places for the relief of the destitute. In New York, when an able-bodied person applies for relief, he is required, as a condition of obtaining it, to indorse an order for admission to the workhouse. The principal trouble in the United States is found in connection with vagrants, large numbers of whom roam the country, living by beggary, pilfering, and extorting money by threatening. A calculation made a few years ago showed that 200,000 acts of relief, at an expenditure of £40,000, were annually bestowed upon such persons by the public officials of the State of New York alone.

Looking at most of the systems of poor relief on the Continent, there is one feature which specially distinguishes them from that of our own country. There are only three countries, Denmark, Sweden, and Prussia, in which there is a legislative declaration of the right of every destitute person to be supported by the state, and of these Denmark is the only state which provides for the relief of pauperism by a special tax. The Danish poor law closely resembles that of England. In Prussia the communes are bound to rely as far as possible on the proceeds of capitalized funds and charitable foundations appropriated to the relief of the poor; but they are also allowed to have collections made in churches or from house to house, and to set up poor boxes in hotels and restaurants. Local taxes on game, and on theatres and public exhibitions, go to the poor, as also do various fines and penalties; but special poor taxes are expressly forbidden by a cabinet order. Modes of administration differ; and at Elberfeld, where the care of the poor has been taken out of the hands of the clergy and placed under civic control, it has reached a high degree of efficiency, and while begging has been virtually abolished, pauperism is reduced to a minimum. The secret of success is constant and personal supervision, this being undertaken by an unpaid agency, the town divided into quarters, and each visitor having no more than four families under his care. In 1874 the system was adopted in Bremen and other parts of Germany.

In Austria the law works in some respects much as in England. Every poor person unable to earn a living can claim to be supported in the commune to which he belongs.

There is a "poor institute" in each parish, supported by voluntary contributions, by collections in church and from house to house, by testamentary gifts, by a tax on auctions, and by fines on smuggling. Houses of compulsory labour exist in Vienna and many other Austrian cities, in which work is imposed upon idlers, beggars, and persons with no honest employment. Labour is also enforced upon such persons by the Prussian law. In France the *Bureaux de Bienfaisance* offers perhaps the most successful existing instance, on a large scale, of "charity organization." There is no poor law; public aid is but to a small extent granted by the state to indigent persons, and no one has a right to claim relief; no man, however poor, can do more than appeal to the charity of those who possess the means of assisting him. On the other hand, the nation fully recognizes the claim which the indigent have upon their charity, and has therefore organized a scheme by which real distress is sure to be discovered and relieved, with the least possible cost of time and money to the donor and of self-respect to the recipient. The scheme is the very perfection of organization for charity which finds vent in a hundred different forms; and though, possibly, the sum spent in France in relief of the indigent is not less than that actually expended for poor relief in the United Kingdom, a "pauper" such as is so familiar to us, is an unknown creature to our French neighbours.

Much light is thrown on this subject by a series of essays on "Poor Reliefs in different parts of Europe," edited by A. Emininghaus, and revised by Mr. Eastwick, M.P. (London, 1878); still further by a series of reports obtained on the same subject through the Foreign Office in 1875, from her Majesty's representatives abroad; and by an able article in the *Nineteenth Century* of February, 1879, on "The Poor in France."

POPE (*Papa*, in Latin) is the title assumed by the Bishop of Rome as head of the Roman Catholic Church. The word *papa*, or *papas*, meaning father, is used by the Greeks to denote a presbyter. Gregory VII., in a council held at Rome in 1076, decreed that the title *Papa* should be given only to the Bishop of Rome.

Originally the election of the Pope was by the priests and people of the diocese of Rome, but subsequently by the cardinals. In the eleventh century Nicholas II. conferred on the latter the right of directing the election, and, in accordance with his statutes, they were bound to demand of the Roman people and the Roman clergy the ratification of their choice. To legalize the election it was indispensable that the same name should obtain two-thirds at least of the votes of the conclave (or assembly of cardinals as an elective body), together with the suffrages of the people and the clergy of Rome. This mode of proceeding, however, was found to give rise to dissensions, and the consequence was that both the clergy and the people were excluded from all participation in the election. This change took place in 1217, on the accession of Gregory X.

The sovereign pontiff is the absolute and irresponsible ruler of the Roman Catholic Church. [As to the original meaning of the word pontiff, see *PONTIFFEX*.] His judgments are held to be infallible when speaking *ex cathedra* on matters of faith and morals. The pontiff may seek advice from the College of Cardinals, consisting, when complete, of six cardinal bishops, fifty cardinal priests, and fourteen cardinal deacons, a large proportion of whom are Italians by birth.

The cardinals are princes of the church. In the early ages they were the principal priests of the churches in Rome or deacons of districts. In the eleventh century they numbered only twenty-eight; and it was in modern times that the number was raised to seventy. When assembled they form the Sacred College, compose the Council of the Pope, preside at special and general congregations, and govern the church so long as the pontifical throne is

vacant. They received the distinction of the red hat under Innocent III., during the Council of Lyons, in 1245; and the purple from Boniface VIII., in 1294.

The right of election of a pope vests in the College of Cardinals, and this right is inviolable; nothing can touch it. The election takes place at the Vatican, where all the cardinals are locked up together till they have come to a decision. (Hence the term conclave, from Lat. *clavus*, a key.) No name is proposed, no speeches are made, hardly a word is spoken. In the centre of the room stands a chalice or electoral urn. Each cardinal in turn writes upon a strip of paper the name of the candidate for whom he votes; and this strip of paper, doubled up, is by the conclavists deposited in the chalice. When the votes of the college have been thus collected, the names of the candidates are read aloud, and the number of votes announced. The Pope must be elected by a majority of two-thirds of the college; and if any name attains this number on the first ballot he is at once elected. But if no one gets this number, the voting papers are burned, and a second ballot is taken, and if necessary a third. It is understood, however, that at the third ballot no cardinal will vote a second time for the same candidate. If, therefore, he still adheres to his first choice, he writes *nemine* on his voting-paper, which means that he votes for no one; and thus at the third ballot, by this process of casting out, a majority of two-thirds is obtained, and the Pope is elected.

The courts of France, Spain, and Austria possess each, in turn, one veto upon the vote of the College of Cardinals; and they may exercise this veto without a word of explanation. This right, as might be expected, is very seldom exercised. As lately, however, as 1830, the court of Madrid exercised its right by vetoing the election of Cardinal Giustiniani.

For the manner in which the Pope carries on the spiritual government of his extensive flock, see ROMAN CATHOLIC CHURCH and CONCORDAT. Notices of the most distinguished of the popes will be found under their respective names; all, however, are included in the following list. The chronology of the earlier popes is often obscure, and the dates are not absolutely certain.

According to most authorities of the Roman Church, the apostle Peter was the first bishop of Rome, and suffered martyrdom A.D. 67. (The date is variously stated.) He is said to have intrusted in his lifetime the see of Rome to Linus, a native of Etruria, who died in the year 78. Linus was succeeded by Cletus, and he by Clemens Romanus, who died A.D. 100. Anacletus followed Clemens. Evaristus, a native of Palestine, is recorded as the next bishop of Rome, and was succeeded by Alexander I. about 109. Alexander I. was succeeded by Sixtus I., a Roman, in 119. Sixtus was succeeded in 127 by Telesphorus, a Greek, who is said by Irenæus to have suffered martyrdom about the year 138. Hyginus, a native of Athens, succeeded Telesphorus, and was succeeded in 142 by Pius I., a native of Aquileia. Pius was succeeded in 157 by Anicetus, a native of Syria. Anicetus was succeeded in 168 by Soterus, who was succeeded in 177 by Eleuthernus, in whose time Irenæus visited Rome. Eleuthernus was succeeded in 193 by Victor I., a native of Africa. To Victor succeeded Zephyrinus, in 202. Zephyrinus was succeeded in 219 by Callistus or Calixtus I., who governed the see of Rome through a period of comparative tranquillity under the tolerant reign of Alexander Severus. Calixtus was succeeded in 223 by Urban I. Pontianus succeeded Urban in 230, and died in exile. He was succeeded in 235 by Anterius, who a few months after his election suffered martyrdom, during the persecution of the Christians by Maximinus. He was succeeded by Fabianus, in 236. Fabianus was succeeded in 251 by Cornelius, whose election was contested by Novatianus, a Roman presbyter, the first "antipope" recorded in history. Cornelius was succeeded

in 253 by Lucius I. To Lucius succeeded Stephen I. in the same year. Stephen had a warm controversy with Cyprian, bishop of Carthage. Stephen was succeeded by Sixtus II. in 257. Sixtus was succeeded by Dionysius in 259. It was under Dionysius that the heresy of Paul of Samosata broke out. Dionysius was succeeded by Felix I. in the year 270. Eutychianus succeeded Felix in 275, and was succeeded in 283 by Caius, who is said to have been a relative of the Emperor Diocletian. Caius was succeeded in 296 by Marcellinus. Marcellinus died in 305, and after a vacancy of three years, Marcellus was elected in 308. Eusebius succeeded Marcellus in 310, who was succeeded in the same year by Melchades, in whose time Constantine defeated Maxentius and took possession of Rome. Melchades was succeeded in 314 by Sylvester I., during whose pontificate Constantine convoked the great Council of Nicæa (*Nikaia*), to which Sylvester sent two priests as his legates. In that council it was decreed that the Bishop of Rome should be primate over the churches of those provinces which in civil matters were subject to the jurisdiction of the "vicarius urbis," or imperial vicar of Rome.

Fourth Century.—314, St. Sylvester I., died 336; 337, St. Julius I., a native of Rome; 352, Liberius, a Roman, banished by the Emperor Constantius (Felix II., substituted by Constantius, is considered by most as an intruder); 366, St. Damasus I., a Spaniard, elected after the death of Liberius (Ursicinus, antipope against Damasus); 384, St. Siricius, a Roman, succeeded Damasus; 398, St. Anastasius I., a Roman.

Fifth Century.—402, St. Innocent I., native of Albano; 417, St. Zosimos, a Greek; 418, St. Boniface I., a Roman; 422, St. Celestine I., a Roman; 432, St. Sixtus III., a Roman; 440, St. Leo I. of Rome, called the Great; 461, St. Hilarius, a native of Sardinia; 468, St. Simplicius, a native of Tibur; 483, St. Felix III. of Rome; 492, St. Gelasius I. of Rome; 496, St. Anastasius II. of Rome; 498, St. Symmachus, a native of Sardania.

Sixth Century.—514, St. Hormisdas, a native of Frusino; 523, St. John I., a Tuscan; 526, St. Felix IV., a native of Beneventum; 530, St. Boniface II. of Rome; 532, John II. of Rome; 535, St. Agapetus I. of Rome; 536, St. Sylvester, a native of Campania; 537, Vigilius, a Roman; 555, St. Pelagius I., a Roman; 560, St. John III. of Rome; 574, St. Benedict I. of Rome; 578, Pelagius II. of Rome; 590, St. Gregory I. of Rome, styled the Great.

Seventh Century.—604, Sabinianus, a native of Tuscany; 607, Boniface III. of Rome; 608, Boniface IV., a native of Abruzzo; 615, Deusdedit or Deodatus I. of Rome; 618, Boniface V., a Neapolitan; 625, Honorius I., a native of Capua; 638, Severinus of Rome; 640, John IV., a native of Dalmatia; 641, Theodoros, a Greek; 649, St. Martin I. of Tuderum; 654, Eugenius I. of Rome; 657, Vitalianus, a native of Signia; 672, Deusdedit II. of Rome; 676, Donnus I. of Rome; 678, St. Agathon, a Sicilian; 682, St. Leo II., a Sicilian; 684, St. Benedict II. of Rome; 685, John V., a native of Syria; 686, Conon, a native of Thrace; 687, St. Sergius I., a native of Palermo.

Eighth Century.—701, John VI., a native of Greece; 705, John VII., a native of Greece; 708, Sisinnus, a native of Syria; 708, Constantine, a Syrian; 715, St. Gregory II. of Rome; 731, Gregory III., a Syrian; 741, St. Zacharias, a Greek; 753, Stephen II.; 757, Paul I., a Roman; 768, Stephen III., a Sicilian; 772, Adrian I., a Roman; 795, Leo III., a Roman.

Ninth Century.—816, Stephen IV., a Roman; 817, Paschal I., a Roman; 824, Eugenius II., a Roman; 827, Valentinus, a Roman; 827, Gregory IV., a Roman; 844, Sergius II., a Roman; 847, Leo IV., a Roman. Benedict III., a Roman; 858, St. Nicholas I. (the Great), a Roman; 867, Adrian II., a Roman; 872, John VIII., a Roman;

882, Martin II., called by some Marinus I.; 884, Adrian III., a Roman; 885, Stephen V., a Roman; 891, Formosus, bishop of Porto (Sergius, antipope, and after him Boniface, styled by some Boniface VI.); 896, Stephen VI., a Roman; 897, Romanus, a Tuscan; 897, Theodorus II., a Roman; 898, John IX. of Tibur.

Tenth Century.—900, Benedict IV., a Roman; 903, Leo V., a native of Ardea (Christopher, antipope); 904, Sergius III.; 911, Anastasius III., a Roman; 913, Lando, a native of Sabina; 914, John X., a Roman; 928, Leo VI., a Roman; 929, Stephen VII., a Roman; 931, John XI., son of Sergius III.; 936, Leo VII., a Roman; 939, Stephen VIII., a Roman; 943, Martin III., called by some Marius II.; 946, Agapetus II.; 956, John XII. (Ottaviano Conti). He was the first who changed his name on his assumption. 963, Leo VIII., styled antipope by some; 964, Benedict V., a Roman; 965, John XIII., a Roman; 972, Benedict VI., was killed in a tumult; 974, Boniface VI., by some called an antipope; 974, Domnus II., a Roman; 974, Benedict VII., of the Conti family; 983, John XIV., put to death by Franco, antipope, styled Boniface VIII.; 985, John XV., a Roman; 986, John XVI., a Roman; 996, Gregory V., a German; 999, Sylvester II. (Gerbert), native of Auvergne.

Eleventh Century.—1003, John XVII., and afterwards John XVIII., Romans; 1009, Sergius IV., a Roman; 1012, Benedict VIII., of Tusculum; 1024, John XIX. of Rome; 1033, Benedict IX., deposed (Sylvester, bishop of Sabina, antipope; John XX., antipope); 1044, Gregory VI. of Rome, abdicated; 1046, Clement II. of Saxony, bishop of Bamberg; 1048, Damasus II. (Poppo), bishop of Brixen; 1049, St. Leo IX., bishop of Toul. Final separation of the Greek Church. 1055, Victor II., bishop of Eichstadt; 1057, Stephen IX., abbot of Monte Casino; 1058, Benedict X., antipope, abdicated; 1058, Nicholas II. of Burgundy; 1061, Alexander II. of Milan; 1073, St. Gregory VII. (Hildebrand), a monk (Guibert, antipope, assumed the name of Clement III.); 1086, Victor III., a native of Beneventum; 1088, St. Urban II., a native of France; 1099, Paschal II., a native of Tuscany (Albert and Theodoric, antipopes).

Twelfth Century.—1118, Gelasius II., a native of Caleta; 1119, Calixtus II., a native of Burgundy; 1124, Honorius II. (Cardinal Lambert); 1130, Innocent II., a Roman (Anacletus, antipope); 1143, Celestine II., a Tuscan; 1144, Lucius II. of Bologna; 1145, Eugenius III. of Pisa; 1153, Anastasius IV., a Roman; 1154, Adrian IV. (Nicholas Breakspear), an Englishman; 1159, Alexander III. (Cardinal Orlando Bandinelli), of Siena (Cardinal Octavian, antipope, by the name of Victor; Cardinal Guido, antipope, by the name of Paschal; Calixtus, antipope); 1181, Lucius IV. (Cardinal Ubaldo), of Lucca; 1185, Urban III. (Uberto Crivelli); 1187, Gregory VIII. of Beneventum; 1188, Clement III. (Paul), Bishop of Præneste; 1191, Celestine III. (Hyacinthus), a Roman; 1198, Innocent III. (Cardinal Lotharius), of Signia.

Thirteenth Century.—1216, Honorius III. (Cardinal Savelli), of Rome; 1227, Gregory IX. (Cardinal Hugo), of Anagni; 1241, Celestine IV. of Milan; 1243, Innocent IV. (Cardinal Fieschi), of Genoa; 1254, Alexander IV. (Binaldo Conti), of Anagni; 1261, Urban IV., a Frenchman; 1265, Clement IV., a native of Languedoc; 1271, Gregory X. (Tobaldo Visconti), of Piacenza; 1276, Innocent V., a native of the Tarentaise; 1276, Adrian V. (Ottobono Fieschi), of Genoa; 1276, John XXI. of Lisbon; 1277, Nicholas III. (Cardinal Orsini), of Rome; 1281, Martin IV., a Frenchman; 1285, Honorius IV. (Cardinal Savelli), of Rome; 1288, Nicholas IV. (Cardinal Jerome), of Ascoli; 1294, St. Celestine V., abdicated; 1295, Boniface VIII., (Cardinal Caetani), of Anagni.

Fourteenth Century.—1303, Benedict XI. (Cardinal Nicholas), of Treviso; 1305, Clement V. (Bertrand), of

Bordeaux, removed the Papal See to Avignon in 1309; 1316, John XXII. (James of Cahors), of France (Nicholas, antipope in Italy); 1334, Benedict XII., a Frenchman; 1342, Clement VI., of Limoges in France; 1352, Innocent VI. (Stephen Aubert), of Limoges; 1362, Urban V. (William Grimoald), a Frenchman; 1370, Gregory XI. (Peter Roger), a Frenchman, restored the Papal See to Rome in 1378; 1378, Urban VI., a Neapolitan (Robert of Geneva, so-called Clement VII., at Avignon, antipope); 1389, Boniface IX. (Peter Tomacelli), of Naples (Pedro de Luna, a Spaniard, antipope, as Benedict XIII. in 1394).

Fifteenth Century.—1404, Innocent VII. (Migliorati), of Sulmona; 1406, Gregory XII. (Angelo Corrari), of Venice, abdicated at Constance; 1409, Alexander V. (Peter Philargios), of Candia; 1410, John XXIII. (Cardinal Cossa), deposed by the Council of Constance; 1417, Martin V. (Otho Colonna), a Roman; 1424, Clement VIII., antipope, schism ends by his abdication in 1429; 1431, Eugenius IV. (Condulmero), a Venetian; 1439, Amadeus, duke of Savoy, elected by the Council of Basel pope as Felix V., antipope; 1447, Nicholas V. (Cardinal Thomas), of Sarzana; 1455, Calixtus III. (Alfonso Borgia), a Spaniard; 1458, Pius II. (Æneas Sylvius Piccolomini), of Siena; 1464, Paul II. (Peter Barbo), of Venice; 1471, Sixtus IV. (P. della Rovere), a Genoese; 1484, Innocent VIII. (G. B. Cibo), a Genoese; 1492, Alexander VI. (R. L. Borgia), who was a Spaniard.

Sixteenth Century.—1503, Pius III. (F. T. Piccolomini); 1503, Julius II. (Julian della Rovere), a Genoese; 1513, Leo X. (Giovanni de' Medici); 1522, Adrian VI., of Utrecht; 1523, Clement VII. (Giulio de' Medici); 1534, Paul III. (Alessandro Farnese), of Rome; 1550, Julius III. (Giovanni Maria del Monte), of Rome; 1555, Marcellus II. (Cardinal Cervini); 1555, Paul IV. (G. P. Caraffa), a Neapolitan; 1559, Pius IV. (G. A. Medichini), of Milan; 1566, St. Pius V. (Michele Ghislieri), of Alessandria; 1572, Gregory XIII. of Bologna; 1585, Sixtus V., of Montalto in the Marca d'Ancona; 1590, Urban VII. (G. B. Castagna), a Genoese; 1590, Gregory XIV. (Nicolo Sfondati), of Milan; 1591, Innocent IX. (G. A. Facchinetti), of Bologna; 1592, Clement VIII. (Ippolito Aldobrandini), a native of Fano.

Seventeenth Century.—1605, Leo XI. (Alessandro de' Medici), of Florence; 1605, Paul V. (Camillo Borghese), of Rome; 1621, Gregory XV. (A. Ludovici), of Bologna; 1623, Urban VIII. (M. Barberini), a Florentine; 1644, Innocent X. (G. B. Pamfilii), of Rome; 1655, Alexander VII. (Fabio Chigi), of Siena; 1667, Clement IX. (Giulio Rospigliosi), of Pistoia; 1670, Clement X. (Emilio Altieri), of Rome; 1676, Innocent XI. (B. Odescalchi), of Como; 1689, Alexander VIII. (P. Ottoboni), of Venice; 1691, Innocent XII. (A. Pignatelli), of Naples.

Eighteenth Century.—1700, Clement XI. (G. F. Albani), of Urbino; 1721, Innocent XIII. (M. A. Conti), of Rome; 1724, Benedict XIII. (V. M. Orsini), of Rome; 1730, Clement XII. (Lorenzo Corsini), of Florence; 1740, Benedict XIV. (P. Lambertini), of Bologna; 1758, Clement XIII. (Carlo Rezzonico), of Venice; 1769, Clement XIV. (Gian Vincenzo Ganganelli); 1775, Pius VI. (Angelo Braschi), of Cesena.

Nineteenth Century.—1800, Pius VII. (G. B. Chiaramonti) of Cesena; 1823, Leo XII. (A. della Genga), of Romagna; 1829, Pius VIII. (Cardinal Castiglioni), of Cingoli; 1831, Gregory XVI. (Mauro Capellari); 1846, Pius IX. (Giovanni Maria Mastai Ferretti), a native of Sinigaglia, who, in June, 1871, celebrated the twenty-fifth year of his pontificate, being a longer period than that attained by any previous pope. Died, 7th February, 1878, and was succeeded by Leo XIII. (Giacchino Pecci), formerly pontifical Camerlengo.

Of the first fifty-six popes, all save Liberius, are saints in the Roman calendar. Some authorities consider Liberius

also as a saint (see Abbé Migne, for example, *Ency. of Theology*). About twenty of the remainder are canonized. They are marked with the letters "St." The last pope not an Italian who has occupied the papal throne is Adrian VI., a Dutchman, elected in 1522.

POPE, ALEXANDER, was born in London, 21st May, 1688. Both his parents were Roman Catholics, a circumstance which indirectly exerted a considerable influence on his career. Soon after his birth they withdrew, with their deformed and sickly child, from trade and the city to a pleasant little property at Binfield in Windsor Forest. An old aunt taught him his letters, the family priest his Greek and Latin accidence; writing he taught himself by copying printed books. "I began writing verses," was his own account, "further back than I can well remember;" and at eight he took delight in the perusal of Ogilby's translation of Homer. At the same age he was sent to school at Twyford, where his satirical propensities began already to develop themselves. At twelve he had written a play, with speeches from the Iliad and verses of his own, which was performed by his schoolfellows. His own couplet is worth recording—

"As yet a child, nor yet a fool to fame,
I slipped in numbers, for the numbers came."

The works of the greatest of the then living poets were so much appreciated by him, that from Hyde Park Corner he had to be taken to catch a glimpse of John Dryden at Will's Coffee-house or elsewhere, and "I looked upon him," was his account long afterwards, "even then with veneration." Dryden died on the 1st of May, 1700, and about the same time Pope was recalled from school home to Binfield, there to prepare himself to fill the place left vacant by the death of "glorious John," whose verse was his favourite model. The "Pastorals"—his earliest work of note—were not published until 1709; but five or six years before they had been read and admired. Wycherley, Garth, Granville, Lansdowne, Congreve, and Gay were soon his friends; and when the "Essay on Criticism," published in 1711, had been praised in the *Spectator*, there followed a temporary intimacy with Addison, and a year later (1713) a more lasting friendship with Swift. In 1712 Steele procured the "Messiah" from Pope for the *Spectator*, and in the same year appeared in Lintot's *Miscellanies* the first sketch of the "Rape of the Lock." So famous a man was the young poet of twenty-five that Addison was glad to have him write the prologue to "Cato," performed in 1713. During his residence in London Pope figured among Addison's little court at Button's until a coolness sprang up between them. Pope, who had a grudge of his own to avenge, attacked fiercely Dennis the critic in a prose lampoon ("A Narrative of the Frenzy of John Dennis," 1713), for his assault on "Cato;" but Addison disowned Pope's advocacy, and he and the poet were friends no longer. It was already before this time that Pope had formed a lasting and intimate friendship with two Roman Catholic ladies, the sisters Teresa and Martha Blount, and there is no doubt that had his extremely feeble health permitted he would have married the second. He always loved her, though often unequally, and he left her his household effects and a legacy of £1000, and made her his residuary legatee.

A little earlier, and chiefly to improve his fortunes, he had resolved on translating Homer. His name was now foremost among the poets of the age. He had influential friends in both of the great political parties, and Swift himself canvassed for subscriptions. The dissipation of London were dangerous for a man of Pope's feeble constitution, and he wisely withdrew to Windsor Forest to work at his great task. In 1714 appeared the final edition of the "Rape of the Lock," now expanded to five cantos, and it went through three editions in the first year. In 1716 he removed to Chiswick with his parents. In 1717 his father died; and after about two

years' residence at Chiswick he made a final migration to the house and grounds at Twickenham, with which his memory is always associated. Meanwhile a collected edition of his works (1717) had appeared, containing among other new or unpublished pieces the "Epistle of Eloisa to Abelard," the "Elegy to the Memory of an Unfortunate Lady," while his Homer was nearly completed. The first volume of the Iliad had been issued to subscribers in the June of 1715, and had been completely successful, in spite of Addison's patronage of a rival translation by Tickell, which soon fell to the ground. Pope's translation appeared in annual volumes from 1715 to 1718; the concluding volumes, the fifth and sixth, were published with a dedication to Congreve in 1720. The pecuniary success of the enterprise was as signal as its literary triumph was splendid. For the Iliad Pope received altogether more than £5000—the largest sum which one work had as yet produced in England, and four times as much as Dryden had received for the translation of Virgil. We may as well add here, that in 1723 Pope agreed to translate the Odyssey in three years, with the assistance of Fenton and Broome. It was completed in 1725, when Homer had brought his English translator between £8000 and £9000, worth then considerably more than the same sum in our own day, and which, skilfully invested with the little fortune left him by his father, placed the poet in easy circumstances for the rest of his life. A little before he undertook the translation of the Odyssey, Pope had accepted a commission to edit the plays of Shakspeare. His edition was published in 1722, and was his first, nay, his only literary failure. His fame and success had not passed unchallenged by his inferiors in literature and fortune. His partnership with Fenton and Broome, in the translation of the Odyssey, had been made the subject of gibes, and Pope could never attain the magnanimity of disdaining the petty malice of his Grub Street contemporaries. A visit from Swift to Twickenham in the summer of 1727 did not contribute to make him more patient or more forgiving. In that year appeared the first volume of their joint "Miscellanies," to which Pope contributed the exquisite "Memoirs of P. P., clerk of this parish," a satire on Burnet, and the treatise of "The Bathos, or the art of sinking in poetry," in which contemporary rhymers were lashed in prose indeed, but with a bitterness that preluded the "Dunciad." That wonderful satire appeared in May, 1728, followed in the April of the next year by an enlarged edition, poor Theobald, who had written a scathing and perfectly warrantable pamphlet on Pope's Shaksperian errors, being the hero of both. Three years more of continued and varied application and then Pope struck into a new line, with the fine epistles on "Taste" addressed to the Earl of Burlington (1731), and "Of the use of Riches" (1732), addressed to the good Lord Bathurst, and of which the latter was made an interlocutor. In 1732 appeared the first part of the "Essay on Man," not only anonymously, but with a preface address designed to throw the reader off the scent, and to fix the authorship on any one but Pope. In the same year a hint of Bolingbroke's in conversation led him to begin those "Imitations of Horace," which are among the happiest and most popular of his compositions, and the appearance of which dated from 1733 to 1737. In 1735 occurred the surreptitious publication of his correspondence by Curll, which led Pope himself to issue a genuine edition of his letters in 1737. But it is now perfectly well known that Pope procured the piratical publication himself, in order to justify the production of the complete edition; and further that he obtained his own letters from obscure private friends, altered them greatly, and then inserted them in the collection addressed to sounding names. The almost childish trickiness of the entire proceeding is the worst blot upon the whole career of Pope, for it involved him in endless lies and intrigue. In the following year appeared

the stinging satires, which date themselves by their title "1738." A fourth book, wider in its scope than its predecessors, was added to the "Dunciad;" and, provoked by a retort of Cibber's, Pope published it in 1741 as the completion of a new form of the "Dunciad," with Cibber, instead of Theobald, installed in the post of dishonour, fresh bitterness being infused, new names gibbeted, and the work adapted to the new circumstances of the new time. This was the last of Pope's notable achievements. He had begun the preparation of a complete, correct, and annotated edition of his works; but with 1744 his constitution, always infirm, was breaking fast. For six years his maladies had been gaining ground, and a recourse to stimulants is said to have increased their hold upon him. Bolingbroke wept over his death-bed. Pope received from a priest the last sacrament of his religion. He died at Twickenham on the 30th May, 1744, and was buried in the middle aisle of Twickenham church.

In person Pope was much deformed; he had a protuberance before and behind, and one of his sides was contracted. He was so short that his chair had to be raised to place him on a level with the rest of the company at table. He had a fine and thoughtful, though thin and pale countenance, with vivid eyes and a capacious forehead. He loved and cherished his parents, and on the whole he was steady in his attachments. It is to his credit that in 1738, when Johnson's "London" appeared, he sought out the struggling author at some trouble, and tried hard to get him a comfortable post; in fact, he procured him a nomination to the head-mastership of a public school, but Johnson's want of a university degree foiled his friendly attempt. Savage as he was when provoked he was not an unfeeling man. It has been proved beyond doubt that out of an average income of £800 a year he gave away £100 in charity. This disposes of the charge of miserliness often brought against him. He was frugal, not miserly. He wrote his *Iliad* chiefly upon the backs of old letters: "this paper-sparing Pop!" He could forgive, too; for when his old enemy Dennis was poor and blind Pope wrote a prologue for his benefit night. Of his broad religious feelings one sentence may serve as a sample. Writing to Dean Swift he says, in 1729, "I am of the religion of Erasmus, a Catholic; so I live, so I shall die; and hope one day to meet you, Bishop Atterbury, the younger Craggs, Dr. Garth, Dean Berkeley, and Mr. Hutchinson in heaven"—these being all staunch Protestants.

"For modes of faith let graceless zealots fight,
His can't be wrong whose life is in the right."

—*Essay on Man.*

As a poet Pope stands in his own class second only to Dryden—more polished and graceful, if less vigorous and manly, than his predecessor; and he cultivated himself and his powers with an industry and devotion of which, among the English poets before him, Milton alone had given an example, although in this, as in everything else, Milton towers high above Pope.

Considerable additional light was thrown upon the character and writings of Pope by the publication, beginning in 1871, of the Croker and Elwin (later Elwin and Courthope) edition of the poet's works, embracing, besides the poems, several hundred previously unpublished letters and other new materials. The tenth and last volume appeared in 1886 under Mr. Courthope's sole editorship. The new edition, so ably edited, conferred an inestimable service upon our literature, inasmuch as the changes in English life had been so great that Pope's poems were fast becoming unintelligible to the general reader—not owing to obsolescence of language, for any person of liberal education can read Pope with the same ease that his contemporaries could, but because it is so largely poetry of the time.

POPE (a fish of the Perch family). See RUFFE.

POPIISH PLOT. See OATES, TITUS.

POPULAR (*Populus*) is a genus of trees forming with the **WILLOW** (*Salix*) the order **SALICINÆ**. The flowers are dioecious, borne in catkins, both male and female having a small obliquely cup-shaped perianth protected by a jagged scale. The male flowers have from eight to thirty stamens; the female have a one-celled ovary. The fruit is a two-valved capsule containing several seeds enveloped in a white cottony down, so that they are easily dispersed by the wind. The male catkins appear early in spring, long before the leaves, and are very conspicuous from their length and from the red tint of the anthers. The leaves are broad, entire, deltoid or ovate, often cordate at the base. They are all remarkable for the tremulous motion they exhibit, caused by the length and slenderness of the petiole, which is vertically compressed. The species of poplars are numerous, chiefly confined to the north temperate regions in both hemispheres. They are trees of rapid growth, and some attain a considerable height. The wood is soft, light, and generally white. It is tolerably durable when kept dry, and from the facility with which it can be worked, is found useful for cabinet and toy making, and for boarding floors, &c.; but its chief value is for fuel. The poplars flourish in a moist soil, especially near running streams.

The White Poplar or **ABLE TREE** (*Populus alba*), one of the most important of the European species, attains a height of 90 feet. The Grey Poplar (*Populus canescens*), distinguished by the eight purple stigmas of the female flowers, which are collected into cylindrical catkins, is regarded by some as a variety or subspecies of the white poplar. It is also a native of Britain, continental Europe, and it is thought to be indigenous to this country. The wood of both species is very white and soft, and used in cabinet-making and woodcarving, and also for carts, doors, &c. The **ASPEN** (*Populus tremula*), abundant in the northern parts of Britain, is especially remarkable for the tremulous motion of the foliage. Two closely allied species, *Populus tremula* and *Populus grandidentata*, represent the aspen in North America.

The Black Poplar (*Populus nigra*) is a native of most parts of Europe, but is probably not indigenous to Britain. It is a large tree of rapid growth, from 50 to 80 feet high, with a spreading head, black bark, smooth dark green deltoid leaves, and lax, cylindrical catkins. The wood is yellowish, and is largely used on the Continent for packing-cases, &c. The cottony down from the seeds has been employed in making a kind of felt for hats, and is also used in paper-making.

The Lombardy Poplar (*Populus fastigiata*), believed to be a variety of the black poplar, is common in the Punjab and Persia, whence it was introduced into Southern Europe. The popular name is derived from its abundance in Lombardy. It is an erect, cypress-shaped tree with perpendicular, instead of spreading, branches. It grows very rapidly, and attains a height of from 100 to 150 feet. Its tall, narrow form renders it unsuitable for open situations, but mingled with round-headed trees it affords a pleasing contrast, and it is especially valuable in screening buildings in parks, &c. It is very common in the streets and squares of towns in this country. The wood is almost worthless.

The Cotton Wood or Canadian Poplar (*Populus canadensis*) abundant in North America, is a large tree, the wood of which is especially valued for fuel, and is also used for other purposes. It is planted to some extent in Britain.

The Black Italian Poplar (*Populus monilifera*), now regarded as a variety of *Populus canadensis*, is indigenous to North America. The common name alludes to the fact that it is abundant in Italy and Switzerland. It is the fastest growing of all the poplars, and is extensively planted in Britain, where it attains a height of from 100 to 120 feet, both as an ornamental tree and for its timber, which is of good quality and used for flooring, &c. The ripe female catkins resemble a string of beads.

The Balsam Poplar or Tacamahac Tree (*Populus balsamifera*), abundant in the northern parts of North America, is a tree of moderate size, remarkable for its fine fragrant foliage. The buds yield a gum-like balsam, which is useful as an antiscorbutic and diuretic. It is extensively planted in Britain, where it is very hardy, but does not grow so high as in its native country. The wood is not of much value.

The Ontario Poplar (*Populus canadensis*) is very like the balsam poplar, the buds also yielding a copious gummy secretion, but is remarkable for the size of its heart-shaped leaves. It is found in the United States and Canada; it is planted in England, but does not succeed except on rich soil near water. It is rather larger than the former species, both in America and in this country.

POP-LIN (Fr. *papeline*), the name given to several varieties of plain or figured stuffs, the best of which have a warp of silk and a weft of worsted. The material was originally manufactured at Avignon, and it derived its French name *papeline* (corrupted in England to *poplin*) from the circumstance of its manufacture in *papal* territory. In 1775 the art of weaving poplin was introduced into Ireland by some French Protestant refugees, and Irish poplins soon became famous for their excellent quality. In France the weft had been floss silk, but long-combed wool was substituted for this material in Ireland. For cheap goods cotton and flax yarns are substituted for silk, but the stuffs thus produced have not the lightness, elasticity, or beauty of the true poplins. The chief centres of the manufacture are Manchester, Dublin, and Lyons, but poplin is less popular as a dress material than it was formerly.

POPPY (*Papaver*) is a genus of plants belonging to the order PAPAYERACEÆ. The species are annual or perennial herbs, chiefly natives of Europe and temperate Asia, with fibrous roots and alternate hairy leaves, usually lobed or toothed. They generally contain a milky juice. The flowers are large and showy, solitary, axillary, with two or three concave deciduous sepals, four or six petals, numerous stamens, and an ovary composed of four or more carpels, surmounted by a rayed compound stigma. The fruit is a capsule opening by pores beneath the projecting margin of the persistent stigma, with parietal placentas as numerous as the rays of the stigma projecting into the interior, as shown in fig. 1, *b*, of the Plate.

The most important species is the Opium Poppy (*Papaver somniferum*, fig. 1 in Plate), which produces the well-known drug, OPIUM. Originally a native of the Levant, it is now cultivated in most parts of the world. In continental Europe and India it is largely cultivated for the sake of the oil which the seeds contain in great quantities. This oil does not partake in the narcotic properties of the milky juice of the plant, but is sweet, and is often used in adulterating olive oil. It has for long been used as an article of food and for cooking purposes, and is also employed by painters. Poppy oil-cake is valuable for feeding cattle. The seeds are themselves eaten, and are said to have an agreeable nut-like flavour. In this country the opium poppy is cultivated for the sake of its capsules, the well-known poppy-heads, from which a syrup is made, useful as a sedative in children's complaints; a decoction of poppy-heads makes a useful fomentation. The wild opium poppy plant is an erect annual herb, about 2 feet in height, with light violet flowers, purplish in the centre. Several varieties, with flowers of various colours, are cultivated as ornamental plants; under cultivation the flower readily becomes double. The seeds also vary in colour, two distinct varieties, one with white and the other with black seeds, being cultivated for opium; the former is considered the best.

Several species of poppy are British. The Field Poppy (*Papaver rhæas*) is a very common and troublesome weed in cornfields, with large deep scarlet flowers, deeply pinnatifid leaves, and smooth globular fruits. A syrup is

made from the petals, and used as an anodyne. Varieties with double flowers of various colours are cultivated in gardens. *Papaver dubium*, with large pale red flowers and club-shaped fruits, is common by the sides of fields, but is, like the field poppy, local in its distribution. *Papaver hybridum*, with small purplish flowers and round capsules covered with stiff bristles, is a rare plant, occurring in sandy fields. *Papaver Argemone* is a small plant with a leafy stem, about a foot high, and small flowers, with the petals, which very readily drop off, pale red, black at the base; its capsules are club-shaped, covered with erect bristles. It occurs in cornfields.

Papaver orientale, a native of Armenia and the Caucasus, is cultivated in gardens for the sake of its large red flowers; several beautiful varieties are known in cultivation, one having its petals united to form a funnel-shaped corolla.

The Yellow Horned Poppy (*Glaucium luteum*, fig. 2), common on sandy sea-shores in Britain, belongs to a nearly allied genus distinguished by its very long, pod-like, two-valved, two-celled capsule, often a foot in length, with a bilobed stigma. This beautiful plant has a stout much-branched stem from 1 to 3 feet high, large deeply-cut leaves, and large flowers, with four delicate golden-yellow petals which last but a day. Several other species of the genus *Glaucium* are cultivated in gardens as ornamental plants. The annexed Plate gives illustrations of the Opium Poppy (fig. 1) and the Yellow Horned Poppy (fig. 2). Fig. 1, *a*, shows the capsule or poppy-head entire of the first-named species, fig. 1, *b*, is a transverse section of it, and fig. 1, *c*, the seed. A transverse section of the long narrow capsule of the Horned Poppy is represented in fig. 2, *a*, and the seed in fig. 2, *b*.

POPULATION is the term generally used to designate the totality of human beings existing within a given area at a given moment of time. Under CENSUS we have given an account of some of the modern methods of counting the members of the population of Great Britain and the different parts of the British Empire, and it will be sufficient to note that investigations of a similar character are conducted by most of the civilized countries of the world. As a result of these labours it is possible to obtain a fairly accurate estimate of the numbers of the population of the nations of Europe, India, the United States, and the British Colonies, and also of the proportion of the sexes, the average rate of increase, the age scale, &c., to be found in these places; but when we pass away from these countries to those parts of the world where no proper census has ever been taken, and to those which are only partially explored, it is impossible to obtain anything beyond very general and uncertain results. According to Rehm and Wagner, the population of the world in June, 1882, may be taken as about 1,433,887,500, this number being divided as follows:—

Europe,	327,743,400
Asia,	795,591,000
Africa,	205,823,200
America,	100,415,400
Polynesia,	4,232,000
Polar regions,	82,500

These numbers give, in respect to the density of the populations of these divisions, an average of 88.0 to the square mile for Europe, 46.6 for Asia, 18.1 for Africa, 6.7 for America, and 1.3 for Polynesia.

From the returns given under CENSUS it will be seen that in the United Kingdom the number of females is considerably in excess of that of the males, the proportion of females to each 1000 males being about 1055 in England and Wales, 1076 in Scotland, and 1045 in Ireland. A similar state of things is found in connection with most of the nations of Europe, though with the exception of

Sweden, which in 1870 had 1067 females to each 1000 males, the disproportion between the sexes is less than in the United Kingdom. In Italy the returns show fewer females than males, and the same may be observed of Belgium, while the census of the United States for 1880 showed the proportion of females to males to be 98·54 per cent. only. The reason for the excess of males in the United States is to be found in the circumstance that of the immigrants landing, there are always more men than women, and the same course operates also in Canada, Australia, and most of the colonies of Great Britain, in which a similar disproportion exists. The excess of females in Europe does not arise, as might be imagined, from there being more girls born than boys, for in all countries from which trustworthy statistics can be obtained, the fact is just the contrary. Some extended observations have established the fact that for every 100 girls born there are born in—

	Boys.
England and Wales,	104
Scotland,	106
Ireland,	106
France,	103
Prussia,	104
Bavaria,	103
Austria,	106
Spain,	104
Italy,	104
Russia (in Europe),	105

Male children, however, suffer from a higher rate of mortality than female, and the equilibrium restored during the period about the tenth year of life is finally altered in favour of the female sex by the more perilous occupations of the males, emigration, and war.

With respect to what is sometimes termed the "movement of population," the statistics obtained by all civilized countries show that under normal conditions there is always a tendency towards increase, but that the rate is affected by a great variety of causes. The most potent factor in producing increase of population in a country is the growth of wealth, which allows a larger number of persons to be supported, while war, pestilence, agricultural and commercial depression, and emigration exert influences in the contrary direction. Taking the figures we have indicated as a basis for calculation, it has been estimated that the number of deaths in a year are about 32,000,000, or 88,000 per day, 3600 per hour, and 60 per minute, one human life being thus carried into eternity every second. Of these deaths a proportion, varying between one-fifth to nearly one-third, are of children less than twelve months old. Heavy as is this death-rate, however, the power of reproduction possessed by the human race enables it not only to stand the drain, but also to overtake it, for with the exception of a few of the uncivilized peoples, which are rapidly disappearing, all other races show a steady increase.

From the point of view of political economy the subject of population has received much attention since the time of Malthus, the first edition of whose famous "Essay on Population" appeared in 1798. In it he enunciated his well-known "law of population"—that the human species, "when unchecked, goes on doubling itself every twenty-five years, or increases in a geometrical ratio," while "considering the present average state of the earth, the means of subsistence, under circumstances the most favourable to human industry, could not possibly be made to increase faster than in an arithmetical ratio." That is, man "would increase as the numbers 1, 2, 4, 8, 16, 32, 64, 128, 256, and subsistence as 1, 2, 3, 4, 5, 6, 7, 8, 9," and that any improvement in the lot of the many must be only temporary, as it would inevitably produce a rapid increase of numbers until population again pressed upon the limits

of subsistence, and was once more restrained by the vice and misery thus produced. This doctrine, so destructive to all manner of Utopias, Malthus, in his second edition, modified by supposing "the action of another check to population, which does not come under the head either of vice or misery"—this is the celebrated principle of "self-restraint, moral or prudential." Malthus undoubtedly rendered great service by his able exposure of the evils of our old poor-law system, with its encouragement to improvidence, and even immorality, which eventually brought about its abolition; but, on the other hand, his teachings have furnished the apathetic and selfish among the upper classes with an excuse for looking upon all schemes for permanently bettering the lot of the poor as visionary and impracticable.

In spite of much bitter opposition and controversy the doctrines of Malthus have, with more or less important modifications, been added to the general body of economic science. According to W. Bagehot, in his "Economic Studies" (1880), the assumed laws of population in abstract political economy are these—

(1) "That population would soon outstrip the means of feeding it, if it were not kept down by vice, misery, or self-restraint.

(2) "That in a state of society where self-restraint does not act at all, or only acts so little that we need not think of it, population will augment till the poorest class of the community has only just enough to support life.

(3) "That in a community where self-restraint acts effectually, each class of the community will augment till it reaches the point at which it begins to exercise that restraint."

A political economist does not imagine that vice, misery, or self-restraint are the only causes which affect the rate of increase of population. All he says is, that in the principal commercial communities of the world these causes are now in most powerful operation.

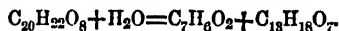
These propositions imply what is known as the Law of Diminishing Returns from Land, which, as stated by Professor Sidgwick, "affirms that the productiveness of labour tends to diminish as the number of labourers to a given unit of land increases, after a certain degree of density of population has been reached," the degree of density varying with the development of the industrial arts and the accumulation of capital. In all branches of industry, except agriculture and mining, a Law of Increasing Returns applies, without any limit, from density of population, except such as arises from sanitary considerations. "The closer human beings live to one another, the greater tends to be the *quantum* of utility derived from a given *quantum* of labour in conveyance and communication. The greater, therefore, tends to be the development of co-operation by exchange; and as the scale on which each particular branch of manufacture may be profitably organized becomes thus proportionally larger, the production itself tends correspondingly to be more economical."

It seems to be generally assumed, however, that in England and the European countries most advanced in civilization the growth of population has so far passed the point at which the law of diminishing returns from land comes into play, that the loss under that head more than counterbalances the gain to manufactures and trade under the law of increasing returns, and that, therefore, *ceteris paribus*, the average efficiency of labour begins to be decreased by any addition to its quantity. But this is not universally admitted. Sir James Caird, a great authority on English agriculture, has asserted that even in England the free application of capital and labour to land in modern scientific farming would produce a more than proportionate increase of production. In other words, the period of diminishing returns from land has not yet been reached. If this be so, it would seem to follow that the existing

want and distress, apart from that caused by vice or disease, are not so much an evidence of over-population as of the imperfect utilization of the labour and capital of the community, and also, of defects in the distribution of the products of labour.

The subject of population in these aspects cannot, however, be fully discussed in the limited space available here, but will be found treated with great ability in Professor H. Sidgwick's "Principles of Political Economy" (London, 1883).

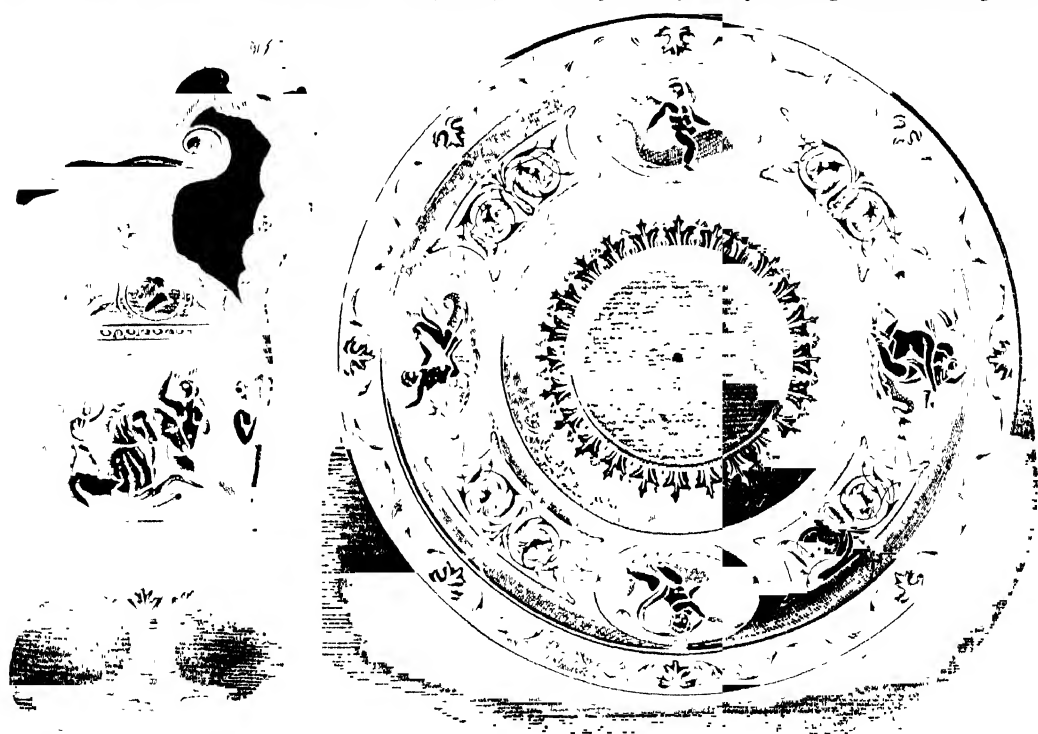
POP'ULIN, or **BENZOYL SALICIN**, is a substance found with salicin in the bark, leaves, and root of the aspen, *Populus tremula*, natural order Salicaceæ. It crystallizes in silky needles, scarcely soluble in cold water or ether, but very soluble in boiling water and alcohol. The formula of the anhydrous body is $C_{20}H_{22}O_8$; of the crystals it is $C_{20}H_{22}O_8 \cdot 2H_2O$. It melts at 180°C . (356°Fahr .) Boiled with lime it is converted into benzoic acid ($C_7H_6O_2$) and salicin ($C_{13}H_{18}O_7$).



POR'BEAGLE (*Lamna cornubica*) is a species of SHARK belonging to the family Lamnidae. The porbeagle

shark, sometimes called Beaumaris shark, occurs in the Mediterranean and North Atlantic, and frequently wanders to the coasts of Britain; it has been also taken off Japan and New Zealand. It attains a length of 10 feet, and has a short stout body with a long tail. The caudal fin is large and powerful, but the second dorsal and anal are very small. The mouth is wide, furnished with strong lanceolate teeth, all of which have a little cusp on each side of the base; the third tooth of the upper jaw on each side is remarkably small in proportion to the rest. Cuttle-fish, herrings, and other fishes form its usual food, which it appears to swallow whole, its teeth being adapted for seizing and holding the prey rather than for cutting. It is sometimes captured in mackerel and salmon nets. On the Mediterranean coasts it is sometimes eaten.* Two other species of the genus are known.

POR'CELAIN, the more noble material of ceramic art; the other divisions being classed together as pottery. The word porcelain is Portuguese in origin, and means "like a little pig;" it was the name given to a semitransparent shell (the Venus fish) because of its hog's-back outline. Hence vessels of semitransparent clay brought from India by the early Portuguese navigators were distinguished



from the opaque earthenware of Europe by their likeness to the material of the "hog's-back" shell, and were called *Porcellana*.

The article POTTERY deals with the general subject from the practical side, and the article CERAMIC ART from the artistic side; porcelain is only vitrified pottery after all, and those articles give as much information on the subject as is compatible with the limits of the present work. In CERAMIC ART the great development of English porcelain is referred to, and it may here be added that at Derby are now two of the best of our porcelain factories—the older, dating from 1750, in the hands of a private firm, celebrated for its delicately modelled flowers, as well as for fine flower-painting; the younger, a limited company,

founded in 1877, and called the Derby Crown Porcelain Company, which has grown into a very important art laboratory. While reproducing with a skill which leaves little to be desired the old and still popular Derby patterns, with the famous blues both under and over the glaze, there is a constant search after new design and decoration. Some beautiful new "bodies" have been invented, notably one coloured throughout with delicate mauves and greens. Fac-similes of Oriental, and especially of Japanese porcelain, many pieces of which are of great size, the productions of this Derby company, are included in the magnificent national collection at South Kensington, London.

The Royal Porcelain Works at Worcester produce most beautiful works. They have a speciality for enamelled

porcelain, exquisite designs being produced from thickening the enamel in some parts and scraping it away to show the ground in others. As a specimen of this very beautiful manufacture the ewer and dish shown in the accompanying illustration may be taken.

The first European who is recorded to have penetrated into China, and to have explored Chinese productions on their own soil, was the Venetian, Marco Polo. Writing in the thirteenth century, this famous traveller alludes to the extent and importance of the porcelain manufactures in the Celestial Empire, and he states of one place, Kinsai, that there was nothing further to be observed, than that cups or bowls and dishes of porcelain wares were there manufactured. Marco Polo returned to Venice in the year 1295, and died there in 1323. It seems to be highly probable that Chinese porcelain had been exported in considerable quantities to other Eastern countries, many centuries before it was seen in China by Marco Polo. Thus mention is made of a service consisting of forty pieces having been sent in 1171 to Noureddin, the caliph of Syria, by his lieutenant, Saladin, who afterwards became the hero of the Crusades. This present may be considered to have travelled by way of Egypt, into which country and into Persia there can be no doubt of porcelain having been introduced direct from China, at a very early period, as an article of commerce. In 1474 the Venetian ambassador at the court of Persia considered it to be his duty to submit to his government a special communication upon the subject of this art-manufacture. Fifteen years later, among other rare and costly presents, an ambassador from the Soudan of Egypt brought to Lorenzo di Medici some large vases of Chinese porcelain. Early in the following century the Portuguese, who doubled the Cape in 1497, imported the finest wares of the East, in large quantities, into Europe, and from that period the different European nations gradually became familiarized with porcelain. Cavendish, the celebrated traveller in the time of Queen Elizabeth, is generally supposed to have presented to his royal mistress the first pieces of Oriental porcelain that came into England. Archbishop Wareham's silver-mounted bowl of the pale green thick porcelain, preserved at New College, Oxford, is one of the earliest specimens known now to be in existence in this country.

The composition of the porcelain paste was kept a dead secret in China. Early writers have stated that it was formed from marine shells, egg shells, gypsum, and other strange substances, which were tempered and thickened, in order to their being adapted to their future application, by being buried in the earth for eighty or one hundred years. Hence Dr. Johnson's fanciful derivation of the term porcelain itself—*pour cent années*. Lord Bacon entertained the idea that there were strata or beds of the porcelain clays in China which, being buried beneath the surface of the ground, by length of time became congealed and glazed into that fine substance which afterwards produced the China wares. At length some light was thrown upon the subject by the French Jesuit missionary D'Entrecolles, who learned many particulars respecting the production of porcelain, both from his converts and from Chinese books upon the subject, and was permitted in person to witness the actual processes of the manufacture. He fully detailed all the particulars in a letter, dated Jao-tchou, 1st September, 1712, which, together with specimens of the two principal materials, he transmitted to Paris. These specimens formed the basis of a series of experiments by Réaumur that ultimately led, when the proper materials had been discovered in France, to the production of the fine porcelain of Sevres.

The Chinese chroniclers declare porcelain to have been first fabricated under the Han dynasty, which flourished about 185 B.C., thus claiming for the discovery of porcelain an antiquity approaching to 2000 years, and a priority of

at least 1600 years over the first manufacture of this ware in Europe. Pottery they date 2500 years before porcelain. Among the porcelains held in the highest esteem in China, as well as by Europeans, and which were made at early periods, are the celebrated *crackle* vases that are covered with a minute and delicate network of fine surface cracks, produced during the process of manufacture by plunging the heated porcelain in cold water, or by mixing stæatite with the glaze. The cracks having been filled up with some thick, coloured composition, or with a flux that has been tintured ruby-red by dissolved gold, the porcelain receives its finish. The *egg-shell* is another early porcelain in the highest repute. Its texture is so slight and delicate as to be almost transparent, and yet jars and vases of considerable size were made of it, as well as cups, plates, and other smaller objects. It attained to its highest perfection during the second half of the fifteenth century of this era, when it was fabricated as thin as bamboo paper.

See the works referred to in CERAMIC ART and in POTTERY; and also, as regards the special history of European porcelain, "Les Origines de la Porcelaine en Europe," by the Baron Davillier (London, 1883, reprinted from the French magazine *L'Art*, with the original illustrations).

PORCH (Lat. *porticus*), a general term for any projection forming a covered space immediately before the entrance to a building, open in front, and more or less inclosed at its sides. The distinction between a porch and a portico is that, however important it may be as a feature, the former appears only a subordinate part of the building to which it is attached; whereas the other [see PORTICO] may be the whole of a front. Almost the only instance of a porch in Greek architecture is that in the octagonal structure called the Tower of the Winds at Athens. There are few instances either in Norman or Gothic architecture; their spacious portals do not advance beyond the general plan of the building in front. In ancient English domestic architecture, porches, properly so called, are frequent, and are often introduced with picturesque effect.

PORCIA (sometimes incorrectly spelt *Portia*), the name of any lady of the Porcian *gens* of ancient Rome. The most famous Porcia is the daughter of Cato, Cæsar's opponent in the great struggle. She married the consul Bibulus, and at his death Marcus Junius Brutus, the dignified friend of the great dictator. When Brutus thought it his duty to join a conspiracy against the absolute rule of his friend, Porcia suspected him, and upon his hesitating to confide in her she stabbed herself deeply in the thigh without a cry to show her courage. On this proof of her heroism her husband divulged his secret. When the conspirators were driven from Italy after Cæsar's murder, and Brutus fell in the battle of Philippi (B.C. 42), Porcia "swallowed fire." It is surmised that she did not really, as is circumstantially stated, kill herself with live coals, but with the fumes of charcoal. Her friends had deprived her of all weapons, dreading her firm resolve not to outlive Brutus.

PORCIUS, the name of a *gens* or clan of ancient Rome. L. Porcius Festus was the successor of Antonius Felix in the procuratorship of Judæa. [See FESTUS.] The most famous Porcian family was that of Cato. [See CATO.] Other families of distinction were Latro, Licinus, &c.

PORCUPINE (Fr. *Porcépic*, Spring Hog) is the name applied to the members of the Hystricidæ, a family of RODENTIA, remarkable for the armour of spines and bristles with which the body is clothed. The incisor teeth are large and powerful, and of the typical rodent character; the molars are four on each side in each jaw. The skull is remarkably inflated.

The Hystricidæ fall readily into two distinct subfamilies, Hystricini, peculiar to the Old World, and Synetheriniæ to the New. The porcupines of the Old World have imperfect clavicles, a rudimentary thumb on the fore feet, and

four digits to the hind pair, the soles of the feet smooth, the upper lip cleft, and the molar teeth rootless when young; the female has six mammae. The *Syntherisma* have the skull very short, the clavicles perfect, four digits on both feet, the soles of which are covered with tubercles, the upper lip uncleft, and only four mammae; the tail is generally prehensile, in accordance with their arboreal habits.

The Common Porcupine (*Hystrix cristata*) is a native of Southern Europe, being abundant in Italy, Sicily, and Greece, and of North and West Africa. It has a large stoutly built body, measuring about 27 inches, a short tail about 4 inches long, and a large mobile snout. On the back of the head and neck the hairs are converted into stiff bristles, forming a crest which can be elevated and depressed at pleasure. The hinder part of the body is covered with stout hollow spines, the longest of which are 15 or 16 inches, while the short tail is covered with open quills suspended by slender stalks, and when shaken makes a peculiar rattling noise. The colour of the porcupine is grizzled, owing to the alternating shades of white, brown, and black with which the spines are marked. The usual position of the spines is lying nearly flat upon the body, with their points directed backwards. When the animal is excited they are raised so as to be almost at right angles with the body, and then present a very formidable appearance. In its habits the porcupine is nocturnal, inhabiting deep burrows; whence it emerges at night to seek for food, consisting chiefly of roots, tender leaves, fruits, and other vegetable matters. We need hardly say that the story of the porcupine darting its spines at its adversary is fabulous, as are also other marvellous details related by the older writers. The story no doubt arose from the spines being so loosely attached to the skin as to readily fall out. The flesh is very good, and is eaten in Southern Europe. Several species of *Hystrix* are found in India, the Malay region, and South Africa.

Of the Brush-tailed Porcupines (*Atherura*) there are three species, two Malayan, and one found on the West Coast of Africa. They are small animals with a long scaly tail having a large tuft of long flattened bristles at its tip.

The Canadian Porcupine or Urson (*Erethizon dorsatus*), common in the United States and Canada, is about 2 feet in length, and has its spines mixed to a considerable extent with woolly hair. In its habits it is arboreal, its retreat being generally among the roots of an old tree. It feeds on the fruits, buds, and leaves of trees, and in the winter chiefly on the bark. It is sluggish and indolent, but extremely irritable, and its spines cause injury to dogs or other animals which attack it. When disturbed it makes a whining or mewing noise. It pairs at the latter end of September, and brings forth two young ones in April or May. Its flesh, which tastes like flabby pork, is relished by the Indians, but soon grows nauseous to Europeans. The quills or spines are dyed of various bright colours by the native women, and worked into shot-pouches, belts, shoes, and other ornamental articles of dress.

The Brazilian Porcupine (*Syntherisma prehensilis*) belongs to another group of American porcupines, distinguished by the long prehensile tail. It resembles the Canadian porcupine in its habits, living in woods, sleeping by day, and at night climbing trees to feed on fruits, &c. It is more fitted for an arboreal life than the North American species by reason of its prehensile tail, and the presence of a peculiar fleshy pad on the inner side of the foot, between which and the toes the branches are firmly grasped. The spines are short as compared with those of the porcupine of Europe. The body is about 18 inches long. Several other species of these tree porcupines are found in tropical America, one extending into Mexico.

PORCUPINE ANT-EATER. See ECHIDNA.

PORDENONE, GIOVANNI ANTONIO LICHTNIO, called *Il Pordenone*, one of the most distinguished artists of the Venetian school, was born at Pordenone in Friuli in 1488. He was an able colourist, and rivalled even Titian in his flesh tints. He painted in oil and in fresco. He was highly esteemed by the Emperor Charles V. He died in 1589, as it was suspected, of poison. It should be observed that he also adopted the name of Regillo. His works are rarely met with out of Italy. The National Gallery possesses one "Apostle" only.

PORIFERA is the name usually given to that class of the subkingdom Cœlenterata which contains the SPONGES.

PORISM (Gr. *porisma*). An intermediate class of propositions, between problems and theorems, was, as we are informed by Pappos, distinguished by the ancient geometers under this name. Much discussion has taken place on the sense in which the Greek geometers really used the word.

PÔROS (Lat. *porus*), the name of an Indian king who ruled over the district east of the Hydaspes when Alexander invaded India. Probably Pôros was really not an individual name, but a title, as there are several kings of the name recorded—perhaps like Pharaoh in this respect. He assembled an army so formidable that the Greeks were unable to cross the river in its presence. Alexander, however, succeeded in effecting a passage with a portion of his troops 150 stadia further up, and a great battle ensued in which Pôros was defeated. His magnanimity and courage secured to him the favour of his conqueror, who enlarged his sway to the whole tract of country between the Hydaspes and the Hyphasis. Of this empire Pôros remained master till his death, which was caused by the treachery of Eudemus, a Macedonian general.

POROSITY is that condition of material bodies which consists in the discontinuity of their molecules, the intervals between these being called pores (Gr. *poros*, a passage). Porosity is a property common to all the bodies of nature; at least we know none in which the particles are contiguous to one another. In some, as sponge and cork, large holes are visible to the eye, and in all bodies pores, which are after all but holes of not dissimilar kind, may be seen by the aid of a microscope. In bodies whose pores are not even thus to be made manifest, the existence of the intervals between the molecules is proved by various circumstances. Thus water or mercury being contained in an open vessel of wood over the exhausted receiver of an air-pump will, by the pressure of the atmosphere, be forced through the wood, and fall thence in a shower; liquids also are frequently filtered by being made to pass through the pores of paper; and in the Florentine experiment of 1661, for determining whether or not water is compressible, the fluid was by pressure forced through the pores of the vessel of gold in which it was contained. Again, the porosity of bodies is inferred from their elasticity, and the sounds which are heard when the molecules are in a state of vibration; also in transparent bodies (and the most dense metals are, when rendered sufficiently thin, transparent) it is inferred, from the fact that the particles of light pass through them, or that the vibrations of an ethereal fluid take place among the molecules. Finally, the porosity of bodies is proved from the fact that they suffer contraction of volume by being exposed to cold and by mechanical compression, since such contractions can only take place in consequence of the particles being forced closer together than they are in the usual states of the bodies. Graham's three degrees of porosity are distinguished by the permeability of the body under question to gases, thus—(1) where, as in dry wood, gases pass under pressure or by capillarity; (2) where gases will not so pass, but will pass by their own proper molecular movement of diffusion, as is the

case with artificial "blacklead;" (8) where gases will only pass under liquefaction, as is the case with most metals and with true "blacklead."

POR'PHYRY (Gr. *porphureos*, purple), a term originally applied to a dark red or purple rock quarried by the ancients at Jebel Dokhan, in Upper Egypt, and largely employed by the Romans for decorative purposes. This rock—also known under the name of "Rosso antico"—is particularly remarkable from its speckled appearance, produced by numerous light-coloured crystals of felspar scattered through its mass. Many other igneous formations also exhibit the same character, and since these began to be scientifically studied, the original meaning of the term porphyry has somewhat changed: it is now applied to any igneous rock through which are disseminated distinct crystals of one or more minerals, larger than those composing the main mass. More correctly, however, the term is used in its adjectival form, *porphyritic*, and most modern petrologists are inclined to discard the original substantive altogether, on account of its misuse by the earlier students of rock structure. Those who still retain the term employ it chiefly for the varieties of porphyritic felsite—e.g. quartz-porphyry, felsite with disseminated quartz-crystals; orthoclase-porphyry, felsite with disseminated orthoclase-crystals, &c.

POR'PHYRY (Gr. *Porphyrios*), originally named *Malchos*, a philosopher of the Neo-Platonic school, was born in Syria in 238. *Malchos* is the Syrian *Melech* (king); whence *Porphyrios* (royal purple). He was initiated in the doctrines of Neo-Platonism at Athens by Longinus, the author of the treatise "On the Sublime." In his thirtieth year he went to Rome, where he attached himself to the school of Plótiños. Being of a melancholic temperament, and holding, according to the tenets of this sect, that a life in the flesh was a life of bondage, he resolved to commit suicide, but was diverted from his project by the good advice of his master, who, by sending him to travel in Sicily, gave a more salutary direction to his thoughts. From this time forward the ascendancy of Plótiños over Porphyry was complete. The latter became a devoted adherent and able advocate of the Alexandrian philosophy. He wrote a highly eulogistic biography of Plótiños, and superintended with much care the arrangement and publication of his works. On the death of Plótiños in 270, Porphyry became the head of the Alexandrian school of philosophy at Rome. Besides the life of Plótiños, he wrote "On Abstinence from Animal Food," a "Life of Pythagoras," "Starting-points leading to the Intelligible," &c. The most useful, intelligible, and best known of his writings is, however, the treatise "On the Five Predicables," which is frequently printed as an introduction to the "Organon" or logical works of Aristotle. Many of the writings of Porphyry have perished, and among them a violent attack on the Christian religion, which excited much controversy in its day. To this work the widespread celebrity of Porphyry in his own day was mainly due; and the tradition of the powerful impression which it made, and of the rejoinders which it called forth, has been instrumental in keeping his name alive down to the present time. It was publicly burnt by the orders of the Emperor Theodosius II. in 435; and only a few fragments of it remain, preserved in the writings of the early fathers of the church. In the extant writings of Porphyry there is not much that is original. What he chiefly inculcates is a fantastical pietism consisting in an ecstatic union of the human soul with the divine reason, or with something still more transcendent and ineffable. Porphyry relates that Plótiños had succeeded four times in effecting this mystical union; but that he himself, in his considerably longer life, had succeeded only once. Porphyry died at Rome in 306.

POR'POISE (*Phocæna communis*) is a species of CETACEA belonging to the dolphin family (Delphinidæ). The porpoise differs from the true dolphins, with which it is usually confounded by seafaring people, in its round rather blunt muzzle, which is not produced into a beak. It is usually 4 or 5 feet long, but sometimes attains a length of as much as 8 feet. The body is spindle-shaped, terminated by a broad tail, and like that of other cetaceans is smooth and quite destitute of hair. The upper parts are dark gray or bluish-black, and the under parts generally whitish. The dorsal fin and flippers are of moderate size. The eye is small, and the aperture of the ear, situated about 2 inches behind it, so minute that it resembles the hole made



Skull of the Porpoise (*Phocæna communis*).

by a pin. The blowhole is situated exactly over the eyes, and is crescent-shaped. The teeth are numerous, from twenty to twenty-six on each side in each jaw, and differ remarkably in shape from those of the rest of the family, having flattened knob-like crowns.

The porpoise is gregarious, large shoals being usually seen together. It is common on British coasts, entering some of the rivers to some distance; in the Thames it has been seen as high as Richmond. It is found very far north in the Atlantic, and also occurs in the Pacific. The porpoise feeds on fishes, and causes great havoc among the shoals of herrings and mackerel. It is esteemed as food by the natives of Greenland, and in former days porpoise flesh, being considered fish, was eaten in England even as late as the time of Queen Elizabeth. The oil, obtained from the layer of fat beneath the thick skin, is of good quality. The skin itself is made into leather, but the "porpoise hide" of commerce is really the skin of the Beluga or White Whale.

The name porpoise is derived from the French *porre-poisson*, or the Italian *porco-pesce*, and means sea-hog, a name literally translated by the German *meerschwein*.

POR'PORA, NICCOLO ANTONIO, a musical composer, the celebrated pupil of Alessandro Scarlatti, was born at Naples in 1689, and died in the same city in extreme indigence, having quite outlived his fame, in 1767. He is said to have composed over forty operas, besides sacred music, most of which were highly esteemed in their time. Perhaps the art is more indebted to Porpora for having polished and refined recitative and measured air, than for enriching it by the fertility of his invention. He was particularly distinguished as a singing-master. Farinelli, Mingotti, Caffarelli, and many other theatrical singers were among the number of his pupils; but a far higher interest attaches to him as a teacher for the lessons he half unwillingly gave the immortal Haydn, who, to obtain them, attended on him assiduously, performing, it is said, many of the functions of a valet. Porpora's method of training was most remarkable. It is almost certain that he kept Caffarelli for five years to one sheet of exercises, and then dismissed him, saying, "You may go now; you are the greatest singer in Europe."

PORR'IGO. See RINGWORM.

POR'SENA or **PORSEN'NA, LARS**, King of Clusium in Etruria, appears in Roman history as attempt-

ing the restoration of Tarquinius Superbus. He is said to have occupied the Janiculum, 506 B.C., but to have been prevented from crossing the Tiber by the courage of Horatius Cocles. He then tried to reduce the city by famine, but it was saved by the self-sacrifice of another Roman youth, C. Mucius, who penetrated to the Etruscan camp with the design of murdering Porsena, but in ignorance of his person killed the royal secretary instead. When brought before the king he thrust his right hand into the fire on the altar (hence his cognomen Scævola, left-handed) to show his contempt of pain. Struck by his heroism, Porsena released him. Mucius then told him that 300 Roman youths, besides himself, had sworn to take his life. This led Porsena to make peace with the Romans, on condition of their surrendering the lands won from the Veii, and giving twenty hostages, who, however, were afterwards released through the bold venture of Clodia. Such is Livy's story. It is probable, however, that Rome was really conquered by Porsena, as is stated by Tacitus in his history, and that this conquest was part of a general outburst of the Etruscans on Latium, which was checked by their defeat at Aricia under Aruns, Porsena's son (Livy, ii. 15). Lars was the common title given to Etruscan kings. The penultimate of the name Porsena is lengthened by Virgil (*Æn.*, viii. 646), shortened by Martial (*Epig.*, xiv. 98).

PORSON, RICHARD, the eminent critic, was born on the 25th December, 1759, at East Ruston, Norfolk, and was the eldest son of Huggin Porson, the parish clerk, and a weaver by trade. His mother was the daughter of a shoemaker named Palmer, of the neighbouring village of Bacton. The boy was put to the loom as soon as he was able to work. He got his earliest tuition at a school in Ruston and at one in the neighbouring village of Happisburgh, where he acquired that very beautiful handwriting which he retained through life, and where his fondness for arithmetic and his prodigious memory began to display themselves. The curate of East Ruston was attracted to the boy, and voluntarily took charge of his education. Mr. Norris, founder of the Norrisian professorship at Cambridge, then became patron of the "heavy-looking youth," and on being satisfied of his proficiency, after an examination by the Greek professor and two tutors of Trinity, provided for the "unwinning cub's" being sent to Eton, which he entered in August, 1774, where he remained four years, and through the kindness of Sir George Baker he entered Trinity College, Cambridge, in October, 1778. In 1780 he was elected a scholar of the college, and in the following year he became Craven University scholar, and soon after obtained the first chancellor's medal. In 1782 he graduated as third senior optime, and the same year was chosen a fellow of Trinity. He had also turned his attention to criticism, and corresponded with Ruhnken on the subject, showing at the early age of twenty-three that felicitous tact which succeeded so marvellously in restoring difficult and lost readings.

The first occasion of this great scholar's appearing in print was in 1783, when he contributed a notice of Schütz's "*Æschylus*" to *Maty's Review*. For this periodical he subsequently wrote several essays and reviews, and in 1787 he published three letters on Hawkins' "*Life of Johnson*," in which he displayed much caustic humour, effectively exposing the faults and affectations of the biography by the imitation of not a few of them. In the same magazine, in the course of the years 1788 and 1789, appeared his "Letters to Archdeacon Travis on the spurious verse, 1 John v. 7," which may be said to have settled the question respecting the genuineness of this verse for ever. In the year 1792 his fellowship became no longer tenable unless he entered into holy orders, and being unable to do this conscientiously he resigned, and was thus deprived of his only means of subsistence. For a short time he suffered considerable privation, but a subscription was soon

raised for him among his friends, enough money being collected to produce about £100 a year. This he accepted on the condition that the principal was to be returned to the donors at his death, but when this event occurred they or their survivors declined to accept the money, and it was used to found the Porson prize at Cambridge to perpetuate his memory. In 1792 he was elected to the Greek professorship at Cambridge, the salary being £40 a year. He gave an inaugural "prælectio" on Euripides as a dramatist, but delivered no subsequent course of lectures. In 1795 there appeared an edition of the plays of *Æschylus* with corrections by him in one vol. folio from the Foulis press, Glasgow, and another edition in two vols. 8vo. was issued in 1806. In 1796 Porson married a widow lady, Mrs. Lunan, sister of Mr. Perry of the *Morning Chronicle*; but their married life, though a happy one while it lasted, was brief, as the lady sank in a decline in a few months, and Porson, who had given many signs of reformation, relapsed into his former habits of irregular hours and dissipation. His intemperance, indeed, was extraordinary, and many stories are told of his insatiable craving for drink. His favourite beverage was brandy, but no alcoholic liquor came amiss, and it is said that in the absence of anything better he drank a large quantity of spirits of wine intended for the lamp in one house, and swallowed an embrocation in another. In 1797 he commenced what he designed to be a complete edition of Euripides by the publication of the "*Hecuba*;" the "*Orestes*" was published in 1798; the "*Phænissæ*" in 1799; and the "*Medea*" in 1801. A new edition of the "*Hecuba*" followed, in the notes of which he replied sharply to his critics, and a third edition was issued in 1808. At his death were found corrected copies of some of the other dramas of Euripides, especially the "*Hippolytus*," and it may be mentioned that he collated the Harleian MS. of the *Odyssey* for the famous "Grenville Homer." In 1806, when the London Institution was founded, he was appointed librarian with a salary of £200 and a suite of rooms, and he retained this post until his death. His health, however, had been undermined by his intemperate habits, and on the 19th September, 1808, he was seized in the Strand with a fit of apoplexy, and after partially recovering had a second fit, and expired on the 25th of that month in the forty-ninth year of his age. He was buried on the 3rd October in the chapel of Trinity College, Cambridge.

As a scholar Porson stood very high, and for verbal criticism he possessed a rare combination of gifts—a prodigious memory as prompt as it was accurate and extensive, and a sagacity, tact, and felicity in restoring imperfect and analyzing difficult readings that in their ease, correctness, and certainty amounted to genius. In his personal character he was characterized by a high spirit of integrity and independence; he ever displayed great readiness in imparting knowledge and rendering assistance to others, and in spite of his failings he always retained the affection of his friends.

(See the "Imperfect Outline of Porson's Life," by Kidd, prefixed to his collection of Porson's Tracts; "Life," by Watson, 1861; and "Porsoniana" in Rogers' "Table Talk," London, 1856.)

PORT. The primary sense of this word is probably an entrance, place of entrance, or passage. Generally the term is applied to spacious harbours much resorted to by ships, and not to small bays or coves which are entered occasionally, or in stress of weather only. A *free port* is a port open and free for merchants of all nations to load or unload their vessels in, without paying any duty or customs. Free port is also used for a total exemption and franchise which any set of merchants enjoy for goods imported into a state, or those of the growth of the country exported by them. A *close port* is one within the body of a city, as the ports of Rhodes, Venice, Amsterdam.

PORT ELIZABETH, the chief town and port of the eastern region of Cape Colony, South Africa, is built on the slope of the hills which rise on the west side of Algoa Bay, on the Indian Ocean, 500 miles east of Cape Town. It is a thriving, bustling town, the great outlet for the wool crop of all the interior region. It has numerous public buildings, stores, banks, gasworks, and barracks, and lines of railway have been begun to unite it with towns in the interior. It was supplied with water by an aqueduct in 1878, and its harbour was improved in 1881 by a great extension of its pier accommodation. The population is 20,000. It was founded by the British colonists of 1820.

PORT GLASGOW, a contributory parliamentary burgh and seaport of Scotland, in the county of Renfrew, on the Clyde, about 20 miles north-west of Glasgow and 2 miles east of Greenock. It was founded by the magistrates of Glasgow in 1668, as a harbour for ships in connection with their city, the Clyde at that time not admitting of navigation up to Glasgow by vessels of any burden. It was constituted the principal customs port on the river in 1710, and incorporated into a municipality in 1775. For many years its trade and commerce were superior to those of Greenock, but owing to the great improvements effected in the channel of the Clyde, and the superior harbour accommodation afforded by Greenock, its commercial prosperity seriously declined, but is now again increasing. Its chief trade is in American timber. Its harbour has convenient quays, and its graving dock, the first in Scotland, was replaced in 1874 by one with a floor of 310 feet. It contains two Established, three Free, and two U.P. churches, an Episcopal, and a Roman Catholic church, a town-house, custom-house, a small theatre, foundries, ship-building yards, rope-yards, chain cable manufactory, and a sugar refinery. It is a well-built town, being laid out on a tolerably regular and uniform plan. The population of the burgh in 1881 was 10,802; of the parish, 10,913. Port Glasgow ceased to be a port for the collection of customs revenue in 1875, and is now subordinate to Greenock.

PORT HAMILTON, a port of Corea, secured by England by purchase in 1885 as a check upon the Russian establishment of Vladivostok, from which it is distant three days' steam. It is also one day's steam distant from the Japanese coal-mine of Takoshima. The climate resembles that of Madeira, and the temperature is 8 degrees lower than places in the same latitude in Japan.

PORT LOUIS, the capital of the Mauritius, situated in a valley inclosed by lofty basaltic mountains. It is regularly built in somewhat narrow streets, partly planted, and has many handsome houses; a fine open space, called the Champ de Mars; a large ungainly Roman Catholic and a Protestant church, an observatory, a bazaar, library, theatre, botanic garden, hospital, &c. The harbour, defended by batteries and provided with excellent quays, is commodious; and the trade in sugar and other produce is important. The heat is very great, and the death-rate high.

PORT MAHON, a fortified town belonging to Spain, the capital of the island of Minorca, situated on its south side. It is the residence of the military governor and bishop of Minorca, and has more than 13,000 inhabitants. The town is well built, and its harbour, which is one of the best in the Mediterranean, is protected by three forts. It was taken by the English in 1703, by the Spaniards and French in 1756, restored to England in 1763, again captured by the French and Spaniards in 1782, and retaken by the English in 1798, but finally ceded to Spain at the peace of 1802.

PORT OF SPAIN, the capital of the Island of Trinidad, situated near the mouth of the Caroni, in the Gulf of Paria. It is substantially built of stone and brick, with wide streets. It is defended by batteries, and has a safe

and spacious harbour, with a fine mole. The trade in West Indian produce is considerable.

PORT PHILIP, a safe and capacious bay in Australia, on the south coast of Victoria, to which colony it gave its name until 1851, is about 35 miles in length and breadth, and with an entrance 2 miles across. **MELBOURNE**, the capital of the colony of Victoria, is on the banks of the Yarra-Yarra River, which flows into the north side, and on the west side is an inlet, near the head of which is the town of GEELONG.

PORT ROYAL, a celebrated convent of nuns, was founded in 1204 by Mathilde de Garlande, wife of Mathieu de Montmorenci-Marli, during his absence in the Fourth Crusade. The site of the convent was in the thickly-wooded valley of the Yvette, about 8 miles from Versailles, on the left of the highroad leading from Rambouillet to Chartres. The nuns were of the order of St. Bernard de Cîteaux, and had their own abbess. In its early years the establishment received a variety of papal privileges, and in 1228 Honorius III. empowered it to receive lay persons who wished to live in religious seclusion without binding themselves by vows. The history of the convent presents but little of general interest until the appointment of Marie Jacqueline Angélique Arnauld, who was made abbess while still a child, and who, when she attained to womanhood, devised a plan for the reformation of the discipline of her convent. In 1633 Angelica and her nuns settled themselves in a spacious house in Paris, in the Rue du Boulai, the new convent being called Port Royal de Paris. At Paris the community came under the influence of the great Jansenist leader, Duvergier de Hauranne, abbé of St. Cyran, whose teaching was eagerly accepted by the Mère Angélique, and also by other members of the Arnauld family. It was under his influence that in 1637 the building of Port Royal des Champs, which had been left untenanted, became the abode of several pious and learned men, who wished to live a secluded life according to the spirit of the papal bull of 1223, and who were styled "les Solitaires de Port Royal." One of the first of these recluses was Claude Lancelot, the grammarian, and he was afterwards joined by Antoine le Maître, a distinguished advocate, and his brother Louis Isaac, better known in the world of letters by his assumed name De Laey, by Antoine Arnauld, brother of the abbess Angelica, by Simon Sericourt, Pierre Nicole, Nicolas Fontaine, and others.

The austere life of these men, and their great learning and ability gave them considerable influence, and as they devoted much of their time to teaching they soon attracted numerous pupils. Their school flourished from 1646 to 1660, and among their scholars they numbered Tillemont and Racine. During this period they published in concert a number of schoolbooks, including "Nouvelle Méthode pour apprendre la Langue Latine;" "Nouvelle Méthode pour apprendre la Langue Grecque;" "Eléments de Géométrie;" and "Grammaire Générale."

In 1648, the number of nuns and novices of Port Royal de Paris having greatly increased, the Mère Angélique transferred some of them to Des Champs, and the teachers removed to a farm-house called Les Granges, on the neighbouring hill. In the same year Antoine Arnauld came into residence, and Port Royal became identified with the Jansenist cause, for an account of which see under JANSENISM. In 1661 the community was dispersed by force, and from 1664 to 1669 both houses were laid under interdict. In 1669 Port Royal de Paris was separated from the parent house, and with a grant of one-third of the revenues was placed under the management of the Jesuits. The nuns of the abbey of Port Royal des Champs were prohibited from receiving any new members, but were allowed to take in children as pupils. Their enemies, the Jesuits, however, were still unsatisfied, and having procured the bull of Clement XI. in 1705 condemning Jansen, the nuns were

required to subscribe to it, and when they proved inflexible another bull was obtained in 1708 for the final suppression of Des Champs, and the transference of the whole property to the house in Paris. In 1709 the aged sisters were dispersed, and the following year the buildings were levelled with the ground. Even this was not considered sufficient, for in 1711 the bodies which lay buried within the sacred precincts were disinterred and removed elsewhere. Port Royal de Paris continued to subsist, though without exerting much influence, until 1790. The history of this celebrated establishment has been written by several eminent men, the more important modern works being Dr. Reuchlin's "Geschichte von Port Royal" (Hamburg, 1839); Saint Beuve's "Port Royal" (three vols., Paris, 1842-43; fourth edition, six vols., 1878); "Memoirs of Port Royal," by Schimmelpenninck (London, 1878); and Beard's "Port Royal" (new edition, London, 1878).

PORT ROYAL, a town of the West Indies in Jamaica, situated on the south-east coast, at the extremity of a peninsula which forms the south side of Kingston Harbour. It was once one of the most flourishing towns in the Antilles, and contained about 2000 handsome houses; but first an earthquake, in 1692, then fire, and lastly a hurricane, in 1722, laid it in ruins, from which it has never recovered. It is fortified, and contains a naval arsenal, hospital, &c., and its harbour is still a principal station for the British navy.

PORT SAÏD, the Mediterranean port of the Suez Canal; dates its existence from the completion of the canal in 1869. Its harbour consists of two breakwaters thrown out $1\frac{1}{2}$ mile into the Mediterranean to protect the entrance to the canal. Behind this a considerable town has sprung up, containing consulates, hotels, warehouses, and coal depots. The town, however, is little more than a business station on the sand.

PORT TALBOT. See ABERAVON.

PORT WINE. See WINES.

PORTA, BACCIO DELLA, or Bartholomew "of the Gate," that is, the gate of San Pietro Gattolini, near which he lived, was better known as Fra Bartolommeo di San Marco. His family name was Bartolommeo Paghola del Fattorino. See BACCIO.

PORTADOWN is a market and manufacturing town of Ireland, on the Upper Bann River, in the county and 11 miles north-east of Armagh. It is an important railway centre, being the place where the Dublin and Belfast junctions, the Belfast junctions, the Belfast and Clones, and the Dungannon to Derry meet. The Bann falls into Lough Neagh, about $7\frac{1}{2}$ miles below the town, and communicates with the Newry Canal, about $1\frac{1}{2}$ mile above it. The Bann is here navigable for vessels of 60 tons burden. The town is flourishing, and a good many hands are employed in manufacturing linen and cotton goods, which are sent to Banbridge and Belfast. It contains a church and three Presbyterian meeting-houses, three Methodist chapels, two Roman Catholic chapels, and a Baptist meeting-house. It is a first-rate market town for grain, pork, flax, butter, and general farm produce. The population in 1881 was 7850. The town dates from the reign of Charles I.

PORTAL CIRCULATION, the name given to that detached portion of the general circulation which supplies the liver. [See CIRCULATION OF THE BLOOD.] The blood of the portal vein contains, besides the venous blood from the stomach and intestines, the venous blood from the spleen and the mesentery; and of course shares the characteristics of the latter. It is of lower specific gravity than the venous blood of the general circulation, because it is more watery and contains fewer corpuscles and more albumen. It yields less fibrin, and hence a less firm clot than ordinary blood. The portal vein carries venous blood to the liver. The blood of the hepatic vein, which carries venous blood away from the liver, contains less water,

albumen, and salts than that of the portal vein, and, on the other hand, much more extractive. Bernard showed that this was a form of grape sugar. [See LIVER, GLYCOGEN.] The name of the portal circulation is derived from the curious Neapolitan experimentalist and theorist Giambattista della Porta (1550-1615).

PORTAMENTO (Ital., in carrying-fashion, Fr. *Port de voix*), a term used in singing and in violin-playing to express a rapid smooth passage over all or some of the intervening notes when a slip of one of the larger intervals is made; as if the melody did not leap clearly from note to note, but were *carried* or dragged along. The violinist easily plays in portamento by gliding his finger along the string from one note to the other, while the sound still continues, instead of stopping the notes in the usual fashion.

Used with great discretion, the portamento is one of the finest musical effects; but it is so very marked that it is extremely easy to overdo it, when it instantly becomes vulgar. Nothing is a more sure mark of bad taste or faulty training in singing than a perpetual use of the portamento. As a rule the passage is made very quickly to avoid the danger just pointed out, of too strongly coloured an effect; but there are situations in which a slow portamento has a wonderful effect, like the resolution of a discord when the coming note is clearly indicated, and yet its arrival is artistically delayed.

PORTAR LINGTON, an inland town of Ireland, partly in Queen's County and partly in King's County, Leinster province, situated $44\frac{1}{2}$ miles W.S.W. from Dublin, with a population in 1881 of 2477. The town, which stands on the Barrow, here crossed by two bridges, had its ancient name of Cultodry changed into its present by Lord Arlington, who prefixed the term Port in consequence of its being a landing-place on the river. The public buildings are two Protestant churches, a Roman Catholic chapel, a Methodist meeting-house, and a market-house. A branch of the Grand Canal passes near it. The town is the residence of several families who are descendants of French and Flemish refugees, settled here at the Restoration, when the town took its rise. Its chief manufacture is malt. It was a Parliamentary borough until 1885, when it was merged in the county.

PORTATIVE ORGAN. See POSITIVE ORGAN.

PORT-AU-PRINCE, the capital of the republic of Hayti, at the head of a spacious bay on the west coast of the island of HAYTI. It rises imposingly from the shore, but, with few exceptions, consists of wooden houses of indifferent appearance, ranged in spacious but very dirty streets. The chief objects of note, all in a ruinous state, are the imperial palace, the senate-house, the Roman Catholic church, the lyceum, custom-house, and hospital. It has suffered much from earthquakes, and still more from fire. Its commerce is considerable—coffee, cacao, cotton, Campeachy-wood, mahogany, guayac-gum, being the chief exports. The population is about 25,000.

PORTCULLIS, in fortification, is an aggregation of several large pieces of wood joined across one another like a harrow, and each pointed with iron at the bottom. They were generally hung over the gateways of old fortified towns, ready to be lowered in case of a surprise, when the enemy was already in the gateway and gates could not be shut.

PORTER. See BREWING.

PORTER, JANE, sister of Sir Robert Ker Porter, K.C.B., an artist and traveller of some note, was a novelist of considerable reputation in her day; she was born at Durham in 1776, and died at Bristol in 1850. In 1808 she published her first novel, "Thaddeus of Warsaw," which was translated into several languages and procured her election as canoness of the Teutonic order of St. Joachim. In 1809 appeared "The Scottish Chiefs," which

also obtained considerable popularity, and she followed this by several other works.

ANNA MARIA PORTER, the younger sister of the preceding, was born in 1780. She wrote many novels, showing some ability, but not nearly equal to that of her sister. She died at Bristol on 21st June, 1832.

PORTICO. Originally applied without distinction to colonnades and covered ambulatories, this term is now limited to signify a sheltered space inclosed by columns at the entrance to a building; and unless otherwise expressed, roofed with a pediment, like the end or front of a Grecian temple. The term, therefore, as now restricted, answers to the *prónaos* of such a temple. Porticoes are described according to the number of columns in front, viz. tetrastyle, hexastyle, octostyle, &c. They are called prostyle when, as generally happens, they project from the main building. Such as are *in antis*, and recessed within the front of the building, are technically called *loggias*, and are especially liked in Italy, which accounts for their Italian name.

PORTLAND, a seaport in Maine, one of the United States of America, is situated on a peninsula in Casco Bay, and on the Grand Trunk Railway, which connects it with Montreal, and in 1880 had 33,810 inhabitants. The city has a picturesque appearance, rising like an amphitheatre from the sea. It is well laid out, with broad streets and handsome houses, and trees are remarkably numerous. Among its public edifices are—the churches, city hall, court-house, athénæum, with a library of 30,000 volumes; a natural history society and museum, and several banks.

The principal manufactures are—various branches of coopering, boots and shoes, refined sugar, soap, candles, &c. There are also numerous steam flour and oil mills, sailcloth factories, sawing and planing mills, iron foundries, distilleries, &c. Shipbuilding and fishing are also important industries. The harbour is one of the best on the Atlantic coast, the anchorage being protected on every side by land, the communication with the ocean easy and direct, and the depth sufficient for the largest ships. Although in a northern latitude it is never closed by ice except in the most extreme weather, and then only for a few days. It is defended by two forts, and at its entrance, on Portland Head, is a lighthouse, 70 feet high. The trade is chiefly confined to the export of timber, provisions, grain, corn, flour, potatoes, sugar, salt, iron, and fish. The American commerce is mainly with the Island of Cuba, exporting provisions, lumber, and cooperage stock, and importing molasses and raw sugar. There is also an extensive coasting trade. Fully two-thirds of the commerce is British transit trade with the Dominion of Canada, which is conveyed from and to Portland by the Grand Trunk Railway during the winter months when the St. Lawrence is closed. In addition to its foreign commerce Portland enjoys great facilities for inland trade, as, besides the Grand Trunk line to Montreal, several other railways radiate from it in different directions.

PORTLAND, an important town of Oregon, United States of America, situated on the west bank of the Willamette, about 120 miles from its mouth. It is a great railway centre, especially as regards the Northern Pacific Railway, and besides a large transit trade exports wheat, flour, timber, and tinned salmon. Its buildings are on the usual scale of prosperous American cities, and the streets are regular and adorned with maple trees. Works are constantly going on with a view to improving the navigable channel of the river and lessening the obstructions from bars. At the present time there is a depth of 17 or 18 feet at low water. The population in 1880 was 17,577.

PORTLAND, ISLE OF, a rocky peninsula of oolitic limestone, projecting into the English Channel from the Dorsetshire coast, 17 miles W.S.W. of St. Alban's Head, and almost directly opposite to Cherbourg, on the coast of France. There can be little doubt that at one time it was

wholly insulated; but it is now, and for ages has been, connected with the mainland by a singular isthmus, a ridge of loose shingle, thrown up by the sea, and called the Chesil Bank (Sax. *ceasil*, a pebble), which runs parallel to the coast for upwards of 10½ miles, with an average width of 170 yards, and joins it at Abbotsbury. Between this ridge (which, in rough weather, is a place of ill omen for the mariner) and the mainland lies a narrow arm of the sea, called the Fleet, containing at its upper extremity a swannery, which is also a favourite resort of all kinds of wild fowl.

The coast of Portland is rugged and picturesque; the limestone has been excavated by the action of the waves into fantastic hollows and deep caverns; and the ground rises inland from an elevation of 80 feet to that of 490 feet above the sea-level. It is reached from the mainland by a road, about 4 miles in length, formed on the north-east side of the Chesil Bank, which crosses the mouth of the Fleet nearly midway by means of a bridge, 600 feet long, erected in 1838. This leads to Portland Castle, built by Henry VIII. in 1520, to protect the coast from a surprise by the French. It was several times besieged and taken by Royalists and Roundheads in the Civil War; it contains a good collection of ancient arms and some excellent paintings. From thence, through Chesilton, a road ascends the hill to Fortune's Well, the largest village in the island, a point commanding a noble view of the channel and of the chalk cliffs of Dorsetshire. In this vicinity lie the quarries supplying the well-known Portland stone. The annual export is estimated at 60,000 tons, and the extent of the annual excavations at an acre. At this rate the island will supply stone for the next 2000 years. An analysis, by Professor Daniell, shows it to be thus composed:—Silica, 1·20; carbonate of lime, 95·16; carbonate of magnesia, 1·20; iron and alumina, 0·50; water and loss, 1·94.

Castleton, on the coast, is the principal port. Here there are a pier and a stone wharf, a tramroad descending the hill from the quarries, and three-quarters of a mile to the east is the famous breakwater, commenced in July, 1849, under the direction of the late Mr. Rendel, and the last stone of which was laid by the Prince of Wales in August, 1872. Its entire length is 1½ mile, inclosing an area of 6745 acres, of which 1290 have a depth of 5 fathoms and upwards. It consists of two sections—an inner and an outer. The inner runs out from the north-east angle of the island in an easterly direction for 1800 feet, and is separated from the outer by an opening 400 feet wide for the passage of ships. Upwards of 6,000,000 tons of stone, mostly quarried by convicts, were deposited in the construction of this stupendous work, and the labour of 1800 men was employed upon it. In connection with it have been established a naval station for the Channel Fleet, a harbour of refuge, and immense fortifications, designed to render the whole island impregnable.

The Convict Prison, consisting of eight wings, a chapel, hospital, barracks, and cottages for the warders, and capable of accommodating 1500 prisoners, was erected in 1848.

In a hollow of the coast, called Cove of Chmeh Hope, is situated Pennsylvania Castle, occupied by a descendant of William Penn; and here, on a cliff overhanging the sea, towers the ruinous old pentangular keep of Bow and Arrow Castle, 300 feet above the water, and commonly ascribed to William Rufus. It was occupied in 1162 by Robert, earl of Gloucester. The scenery abounds in gleams of the romantic, and some resemblance is often remarked to the rock of Gibraltar.

The southern extremity of the island is a castellated mass of wave-worn, weather-beaten rocks, called Portland Bill, on which there are two lighthouses. Off the point lies a bank called the Shambles, and in the channel between the tide rushes with extraordinary vehemence, forming the much-dreaded Race of Portland. Off its shores a great

naval engagement took place between the English under Blake, and the Dutch under Van Tromp, which continued for three days, and resulted in the total defeat of the latter, with a loss of eleven men-of-war and thirty merchantmen (18-20th February, 1653).

PORTLAND CEMENT is a hydraulic mortar—i.e. a mortar capable of hardening or “setting” under water—and is largely manufactured at the present time from the river-mud of the Medway and that of the mouth of the Thames. The clayey material is mixed with an excess of chalk, and then ground with water into an impalpable paste, termed “slip;” this is dried, and finally burnt in kilns. The hardening of the cement appears to depend upon the formation of carbonate of lime.

PORTLAND STONE, a compact fine-grained limestone, of Upper JURASSIC age, extensively worked for architectural purposes in the quarries of the Isle of Portland, Dorsetshire. It is one of the most durable building stones, and is employed in St. Paul's Cathedral and many other of the principal edifices in London. The rock frequently exhibits curiously-shaped hollows, which are the casts (or moulds) of fossil shells that have been removed by the infiltration of water. The Portland screws—casts of *Cerithium portlandicum*—are especially abundant. The best stone is confined to a stratum about 20 feet in thickness, and there are other outcrops of the same deposit at Tilly Whim, in the Isle of Purbeck, in the Vale of Tisbury, Wiltshire, at Swindon, and in the Vale of Aylesbury. (The “dirt beds” exposed in the Portland quarries form part of the series of PURBECK BEDS.)

PORTLAND VASE. This beautiful specimen of ancient art is one of the choicest treasures deposited in the British Museum. The time of its production is now unknown, but it is presumed to be the work of a Grecian artist. The first information we have respecting it is that about the middle of the sixteenth century the vase was found inclosed in a marble sarcophagus, within a sepulchral chamber, under the eminence called the Monte del Grano, about 2½ miles from Rome on the road to Frascati. This sepulchral chamber appears to have been the tomb of the Emperor Alexander Severus, and of his mother, Julia Mamaea; and the vase was probably a cinerary urn belonging to the sepulchre. The elegance of form and the admirable workmanship of the vase procured for it a place in the palace of the Barberini family at Rome, where it remained more than two centuries; after which it became the property of Sir William Hamilton, from whom it passed to the Duchess of Portland. In 1810 it was deposited in the British Museum by the Duke of Portland. On 7th February, 1845, a young man, a visitor at the museum, wilfully broke the vase into several pieces by throwing a stone at it. The fragments of the vase were afterwards joined together, and the work restored far more successfully than might have been anticipated. Fifty exquisite copies of it were made by Wedgwood.

This vase was said by Montfaucon to be formed of a precious stone; but subsequent examination has shown the material to be dark blue glass, relieved by figures and devices in white enamel.

PORTO BEL'LO, or **PUER'TO BEL'LO**, a seaport town on the north side of the Isthmus of Panama, belonging to the U. S. of Colombia. It is surrounded by mountains, and is unhealthy, but the excellence of its harbour (whence its name) rendered it formerly of high commercial importance. The town has now, however, greatly declined, the population only numbering about 1300. It was taken by Admiral Vernon in 1759, at which time it was strongly fortified.

PORTO CABELLO, or **PUER'TO CABELLO**, a town and port in the republic of Venezuela in South America, situated on what was formerly an island in the Golfo Triste, with about 8000 inhabitants. It is con-

sidered the best port on the south coast of the Caribbean Sea, and the entrance is so narrow that only one vessel can pass at a time. The harbour is deep and spacious, and the largest ships may lie there in safety. The town is small, but contains several good houses, and is well fortified. The suburbs are much more extensive than the city. The commerce of the town is considerable, as it is the main outlet for the produce of Venezuela, and it has a tannery, foundry, and soap and candle factories. The exports consist of cocoa, coffee, sugar, mules, &c.

PORTO DE SANTA MARIA, or **PUER'TO**, is a large seaport of Spain, situated 7 miles north-east of Cadiz, at the mouth of the Guadalete, and has about 22,000 inhabitants. The town is well built, well paved, and very clean. The Calle Larga, a street about a mile in length, has a very handsome appearance, owing to the number of fine shops and elegant buildings which it contains. The quay is well contrived, but large ships cannot come up to it, on account of the bar at the mouth of the river. On the west side of the town there is a very fine prospect of the bay and port of Cadiz. The latter is supplied with drinking water from this place. The climate is excellent, for which reason the wealthy inhabitants of Cadiz reside here during the summer. The only manufacture of consequence is soap, of which large quantities are exported. There are also a few manufactories of hats, and one or two brandy distilleries. This town is the principal depot for the wines of Xeres, situated 7 miles to the north-west. There is communication with Cadiz by small steamers and by carriages that make the land circuit.

PORTO REALE, or **PUER'TO REAL**, a town of about 6000 inhabitants, in the south of Spain, 5 miles east of Cadiz. The streets are airy, clean, and straight, and the houses well built, with flat roofs. The market-place, which is situated in the centre of the town, is a spacious square surrounded by stone arcades, under which all sorts of provisions are exposed for sale. There is also a very handsome stone pier and several commodious wharves of the same material, for the unloading of ships. Near the town are extensive salt works. The process of manufacture is by evaporation in wide and deep basins communicating with the sea by locks.

PORTO RICO, or **PUER'TO RICO**, an island of the West Indies, belonging to Spain, is the smallest of the Greater Antilles, and the most western of the Leeward Islands. Its form is a parallelogram, 108 miles long, and 37 broad. Its area is 3530 square miles. It is considered to be the most healthy island in the West Indies.

A range of mountains of considerable height runs through the centre; the highest part is that of Luguilla in the north-east. The Yungue, the most elevated peak, is about 3600 feet high. From this chain inferior ridges run north and south, containing between them valleys of great fertility watered by many small rivers, which descend from the hills, and some of which are navigable for several leagues from the sea, being deep and broad. The coasts abound with good harbours.

The principal produce of the island consists of sugar, coffee, tobacco, cotton, fruit, vegetables, &c. Its fertility and powers of production are very great, but the southern lowlands are subject to drought, and the northern sometimes suffer from an excess of moisture. One physical phenomenon is remarkable, viz. the extreme poverty of the flora and fauna. The absence of flowers, birds, and wild animals at once strikes the visitor, especially one who may have had experience of other tropical countries. The domestic animals, however, abound, and the cattle are the finest in the West Indies, and many sugar estates, owing to low prices, have been converted into pasture land. The trade of Puerto Rico is chiefly with Spain, the former Spanish American colonies, the United States, Great Britain and Germany, and the enormous productiveness of

the island causes trade to flourish and increase in spite of fiscal regulations which are probably the worst in the world. The financial administration is so disgraceful that the island only possesses one good road of 60 miles from San Juan, the capital, to Ponce, while the harbour of the former, one of the best in the West Indies, so lacks the most ordinary attention, that it is rapidly becoming inaccessible to small vessels.

Owing to the dense population of the island, the small proportion of negroes, and the severe laws against idleness, there is no lack of labour, as in the other West India Islands. The population is about 650,000, the vast majority of whom are whites, or those who pass for such; for the race has a large share of Indian blood, through the intermingling of the settlers with the original natives. Up to 1873 the population included 30,000 slaves, but they were then declared free. The emancipation did not make the difference usually observed on such occasions. The negroes were compelled to enter into contracts of apprenticeship for three years, and continued to work, receiving the current rate of pay, and the rate of production rather increased than otherwise. The industry of the island is entirely agricultural, there being neither mines nor factories. The prevailing religion is Roman Catholic; in fact, until 1873 no person could even reside in the island without declaring himself of this faith.

Puerto Rico is governed by a captain-general, who is president of the royal audiencia, and is assisted by a junta of military officers. It is divided into seven departments. The island was discovered by Columbus in 1493. The Spaniards extirpated nearly all the natives; and the few remaining have intermixed with the Europeans, so that there is very little distinction between the races.

PORTOBELLO is a very handsome modern town of Scotland, on the shore of the Frith of Forth, in the county of and 3 miles east from Edinburgh by the North British Railway, and about half-way between Musselburgh and Leith. The houses are well built of freestone, which is obtained in the neighbourhood. Portobello is resorted to for sea-bathing, the beach being very favourable for this purpose. Hot and cold baths have also been constructed upon an improved plan. It has a town-hall, fine municipal buildings, and a good pier. There are some good hotels and convenient villas for visitors, and a marine parade, overlooking the Frith of Forth. The scenery around is very pleasing. In 1867 an ornamental pleasure ground, called Brighton Park, was opened. There are a parish, a Free, an Episcopal, a Roman Catholic, and two United Presbyterian churches. The town has some small manufactures of terra-cotta bricks, tiles, and stoneware. The population in 1881 was 6926. The name is said to be derived from a cottage erected in 1742 on Figgate Whins, a moorish waste with an evil reputation for thieves and smugglers. The builder of this had served at the taking of Porto Bello in Panama in the expedition of 1789. At Shrub Mount, Portobello, Hugh Miller (1802-56) died by his own hand.

PORTPATRICK, a village and parish of Scotland, in the county of and about 30 miles W. by S. from Wigtown, on the west coast, owes its importance to having been made in 1662 a regular post-packet station, discontinued in 1849, between Scotland and Ireland, being only 22 miles distant from Donaghadee on the Irish coast. It is one terminus of a submarine telegraph cable between the two countries, and is a station on the Caledonian Railway. Piers and quays have been built, and a harbour formed artificially, in place of the former mere inlet between two ledges of rock which advanced into the sea—but it is still incomplete and unsafe. The town is inclosed by steep cliffs, which renders the climate very suitable for invalids, with whom it is increasing in favour as a resort. Portpatrick was long famous as the Gretna Green for Ire-

land. There is a parish church and a Free church. The population of the village in 1881 was 591; of the parish, 1285, many of whom are engaged in the cod fishery.

PORTRAIT-SIZES. The following are the chief sizes used in portrait canvases:—

	Ft.	In.		Ft.	In.
Whole length,	7	10	by	4	10
Half length,	4	2	"	3	4
Small half,	3	8	"	2	10
Kit-cat,	3	0	"	2	4
Three-quarter,	2	6	"	2	1
Head,	2	0	"	1	8

Bishop's whole length and half length are larger than the ordinary sizes under these terms by a foot each way and 6 inches each way respectively. The origin of the term **KIT-CAT** for this very convenient size is given under the article with that heading.

PORTREE, in the Island of Skye, is the name of a parish and maritime village, the former containing a population of 8191, and the latter of 893. The village stands at the head of Loch Portree, and is the capital of the Skye group of the Hebridean Islands. There are an Established, a Free, and U.P., and an Episcopal church, and two branch banks; and from its spacious harbour are exported cattle, sheep, wool, kelp, salted herrings, pickled salmon, dried cod, and ling. Steamers ply regularly to Glasgow, Strom Ferry, and Stornoway. There is a flourishing tweed manufactory, the only one in the island. The name of the village, signifying King's Port, was conferred in honour of a visit of James V.

PORTSEA. See PORTSMOUTH.

PORTSMOUTH, the principal naval arsenal of Great Britain, an important seaport, and parliamentary and municipal borough, is in the county of Hampshire, 16 miles south-east of Southampton, and 74 miles south-west of London by the London and South-western Railway. The town stands on the west side of Portsea Island, at the entrance to Portsmouth harbour, opposite Gosport, with which it communicates by a steam floating bridge. It forms, with its suburbs, Portsea and Southsea, and the chapelry of Gosport, one cluster of population, which amounted to 127,989 in 1881. The boundaries of the municipal and parliamentary boroughs are identical. Two members are returned to the House of Commons.

Portsea Island is 4 miles in length north to south, and from 2 to 3 in breadth, between Portsmouth harbour on the one side, and Langstone harbour on the other. It is connected with the mainland by several bridges and a railway viaduct, and is generally fertile and well cultivated. Its coasts are well defended by new and strong military works, including the fortifications of Southsea Castle, and a long line of intrenched works at Hillsea. The external appearance of Portsmouth is greatly embellished by the fine trees which ornament the ramparts, and the principal entrance to Portsea is very imposing on this account.

PORTSMOUTH PROPER, the oldest and most southerly part of the parliamentary borough, is, generally speaking, a mean-looking town. The High Street, however, the most important thoroughfare, contains good houses, hotels, and public buildings, and the Grand Parade is a spacious open area, used for garrison inspections; but with these exceptions the streets are narrow, and many of them of the lowest character. The parish church of St. Thomas, founded about 1220, and partly rebuilt in 1693, is a large stone edifice, with a square tower 120 feet high, surmounted by a cupola and vane, which forms an important landmark. It contains a monument in memory of Villiers, duke of Buckingham, who was assassinated here in 1628. Adjoining the Grand Parade is the garrison chapel and burying-ground where Sir Charles J. Napier was buried in 1853. There are numerous places of worship for the various

religious denominations, including a Roman Catholic cathedral. The other public buildings are of no note, and include the town-hall and gaol, market-house and exchange, bank, theatre, philosophical institution, museum, library, and several schools. A people's park is somewhat spoiled by a railway traversing it, and there is an officers' recreation ground. Pleasing views of the harbour, roadstead, and the Isle of Wight may be had from the ramparts and batteries.

PORTSEA, about a mile to the north, is built on a tract formerly called Portsmouth Common, but it now greatly surpasses the old town in extent and population. It is divided into two nearly equal parts by its main thoroughfare, Queen Street, which is lined on each side with excellent shops. Some few of the other streets, as St. James' Street, King Street, and the Common Hurd, are tolerably broad and well built. The creek dividing it from Portsmouth has been filled up. Its most important buildings and institutions are the county court, town-hall, convict prison, and Jewish college. There is also a public park. The parish church is an antiquated edifice at Kingston, about $1\frac{1}{2}$ mile from the town. There are several district churches and places of worship for all denominations of dissenters.

SOUTHSEA is situated outside the town walls, and consists of a succession of well-built terraces facing the sea and the east ramparts of Portsmouth. It is inhabited principally by naval, military, and civil government officers, and visitors resorting thither during the summer season, and has all the usual conveniences of a modern fashionable watering-place, including fine hotels, assembly rooms, esplanade, and two piers. Elm Grove and Somerstown are sections of this suburb. The church, dedicated to St. Paul, is an elegant Gothic building, built in 1822. Southsea Common, stretching along the shore, is a fine large open space, used for military reviews and inspections, and for public recreation.

The other suburbs of Portsmouth are Landport and Flat house, to the east and north of Portsea, and Newtown, Kingston, and Buckland, still further east.

GOSPORT is separated from Portsmouth by the mouth of the harbour, which a steam floating bridge traverses every fifteen minutes. It is well built, and the streets cross each other at right angles. The church is a curacy of Alverstoke, and there are several chapels and schools. The market-house is no longer used for its original purpose, but for the meetings of various committees and of the philosophical society. The main feature of the place is the Royal Clarence Victualling Yard, which comprises a royal brewery and cooperage, an extensive ship-biscuit manufactory, worked by steam machinery, and numerous storehouses. In the vicinity is Haslar Hospital, a magnificent asylum for sick and wounded seamen. It was built in 1762, and is capable of accommodating 2000 patients.

Harbour, Dockyard, Fortifications, &c.—Portsmouth harbour, on the west side of Portsea Island, is formed by an inlet from the British Channel. The entrance is less than a quarter of a mile wide, between Portsea and the town of Gosport, and the harbour is somewhat irregular in form, about 3 miles from S. to N., and from 2 to 3 miles from E. to W. It gives an anchorage space at low water of 380 acres. On the east side of Portsea Island is Langston Harbour, about the same size as that of Portsmouth, and separated by Hayling Island from Chichester Harbour. There are thus three large contiguous natural harbours, formed by inlets from the sea, and of which the last two are connected by a channel on the north side of Hayling Island. The greater depth of water renders Portsmouth Harbour by far the best of the three. Its basin is capable of containing the greater part of the navy of Great Britain, and large vessels can enter and lie at anchor at all times of the tide. The roadstead between its mouth and

the Isle of Wight forms an anchorage, part of which is well known under the name of Spithead. Adjacent to this spot, on the coast of the Isle of Wight, near the eastern extremity of the island, is St. Helen's, a place of rendezvous for the navy; and near the coast of the Isle of Wight, between Cowes and Ryde, is the Motherbank, an anchorage for smaller vessels, and the chief British quarantine station.

The dockyard of Portsmouth, in the district of Portsea, is the largest in the kingdom. It includes rope-houses, anchor wharves, anchor forges, a copper-sheathing foundry, electric machine works, and mills; block, mast, sail, and rigging, and other store houses; basins in which vessels are received with all their standing and running rigging to be repaired; building slips, a steam basin and steam factory, docks for repairing—in a word, all that is requisite for the construction, equipment, armament, and repair of vessels. Adjacent to the dockyard is the spacious and well-furnished gun wharf and its connected buildings. It is the grand depot for cannon, shot, and every description of ordnance stores. The dockyards cover an area of more than 300 acres. Some of the docks are capable of receiving the largest ironclads.

Portsmouth was originally fortified by Edward IV. The works were greatly improved during several reigns, and those of the old town were completed under William III. The town was afterwards almost inclosed within a bastioned *encinte*, the rampart faced with masonry, and encircled with moats, with a glacis beyond. These old ramparts are now useless, and are planted with trees. The present fortifications comprise an outer and inner line of land defences, consisting of several forts, some of large size, with strong earthen ramparts, outworks, and bomb-proof barracks, and connected by deep ditches cut in the chalk; and also outer and inner lines of sea defences, some of which are protected by iron shields and mounted with the heaviest rifled guns. Altogether, in spite of some of the parts first constructed having been designed for methods of attack and ordnance now obsolete, Portsmouth may be said to be one of the best defended places of any nation.

The trade of Portsmouth, which is considerable at all times, but especially in time of war, depends much upon the expenditure connected with or caused by the naval station and dockyard, and is of a very miscellaneous character. There is a considerable import of cattle from the Isle of Wight and from the west of England. Corn and provisions are brought in from Ireland, eggs from France, timber from the Baltic, and wine is imported direct from the Continent. Steam communication is kept up with the Isle of Wight, Southampton, Plymouth, Dublin, and Havre. The number of vessels registered as belonging to the port in 1886 was 800 (18,000 tons). The entries and clearances each average 2000 (210,000 tons) per annum.

Portsmouth has a considerable antiquity. It received its first charter from Richard I. In 1872 it was burnt by the French, after which time it seems to have been fortified. In 1648 it was defended by a chain of iron across the harbour mouth, and two round towers, begun by Edward IV. and finished by Henry VII. Henry VIII. made it one of the principal stations for his infant navy, and here the English fleet was collected in July, 1545, when unsuccessfully attacked by the French armada, under Claude d'Annebaut. On board the *Monarque*, then lying in Portsmouth harbour, Admiral Byng was tried, condemned, and shot (14th March, 1757). Here about ten o'clock on the morning of the 29th of August, 1782, the *Royal George*, a ship of 108 guns, while undergoing some repairs, suddenly heeled over and sank in deep water, Admiral Kempenfeldt and between 900 and 1000 men, women, and children unhappily perishing. The wreck, which formed a serious obstruction in the roadstead, was demolished and removed in the summer of 1889. The *Victory*, Nelson's flag-ship (with the dead body of the

great seaman on board) entered the harbour in October, 1806, and the vessel is still preserved. The present municipality consists of fourteen aldermen, and forty-two councillors, including the mayor.

PORTSMOUTH, a seaport and important naval depot of the United States of America, in New Hampshire, situated on the left bank of Elizabeth River, opposite Norfolk, 8 miles from Hampton Roads, and 160 miles by water S.E. of Richmond. The river, which is about half a mile wide, forms a safe and excellent harbour, accessible to vessels of the largest size, in which several ships of war are usually lying at anchor. The general government has at Gosport, a suburb of Portsmouth, a large and costly dry dock, which is capable of admitting the largest ships. At the secession of Virginia, in 1861, it was attacked by some Confederate troops, and was hastily set on fire and deserted by the Federals. Several of the largest vessels in the American navy were either sunk or burnt. Besides the United States naval hospital in the vicinity, a large and showy building of stuccoed brick, Portsmouth contains a court-house, several churches, custom-house, the Virginia Literary, Scientific, and Military Academy, and some tobacco factories. The town is situated on level ground immediately below the junction of the south and east branches of the river, and the streets are straight and regular. The population in 1880 was 9690. Ferry-boats ply constantly from Portsmouth to Norfolk, and daily steamboats communicate with Richmond. Paul Jones' ship, the *Ranger*, the first to carry the "stars and stripes," was built here.

PORTUGAL, THE KINGDOM OF, is the most westerly kingdom of Europe. It forms part of the Spanish peninsula, and is not divided from Spain by any well-defined natural boundaries. All the great rivers of Portugal, the Minho, the Douro, the Tagus, and the Guadiana, have their sources in Spain, and belong to Portugal only in the lower part of their basins. The Mondego is the only considerable river which has its sources and its whole course within the limits of Portugal. The kingdom is bounded on the N. and E. by Spain, and on the S. and W. by the Atlantic Ocean. Its greatest length is about 360 miles from north to south, and its breadth varies from 90 to 145 miles. Its area is reckoned at about 84,420 square miles. It has a coast line of nearly 500 miles, of which about 400 face the west.

Surface, Climate, Productions, &c.—Portugal is intersected by several ridges, which are a continuation of the chains which cross Spain from east to west. In the north, the Serra (from the Arabic *sehrak*, an uncultivated tract) de Maraon is a continuation of the mountains of Astorga, which divide the waters of the Minho from those of the Douro. It enters Portugal north of Braganza, and covers the greatest part of the province of Tras os Montes and part of that of Entre Douro e Minho. South of the Douro is the Serra de Alcoba, which divides the basin of the Douro from that of the Mondego; and south of the Mondego runs the Serra de Estrella, a continuation of the Sierra de Gata, which forms the western part of the great central ridge of Castile that divides the waters of the Douro from those of the Tagus and the Mondego. The Serra de Junto, which is a continuation of the Estrella, runs nearly parallel to the coast, and terminates in the high promontory called Cabo da Roca, the most western point of the Continent of Europe. The highest summit of the Serra de Estrella is 6540 feet above the sea. South of the Tagus, the Serra de San Pedro, a continuation of the Montanas de Toledo, enters Portugal near Portalegre, and divides the basin of the Tagus from that of the Guadiana. Further south is the Serra de Monchique, which may be called a continuation of the Sierra Morvna, being separated from it only by the course of the Guadiana. The great chains of the Portuguese mountains have a general inclination from north-east to south-west, and they throw off numerous offsets, which

cover a great part of the country. Between these chains lie the three basins of the Douro, Mondego, and Tagus. South of the Tagus is the plain of Alentejo, the largest in the kingdom, which is divided on the south-east by the mountains of Portalegre, Estremoz, and Evora, from the basin of the Guadiana, which, differing in this respect from the other great rivers of Portugal, has a general direction from north to south, and belongs, even in its lower course, partly to Portugal and partly to Spain. The province of Algarve, situated at the southern extremity of the kingdom, is separated from the rest by the Serra de Monchique, and forms a strip of land between the mountains and the sea, which has a general slope to the south, and is traversed by numerous torrents running from north to south. There are no lakes in the country, but several marshes.

The climate of Portugal presents considerable variations in the northern and southern provinces. The latter are very hot in summer and are subject to droughts; upon the whole, however, the country may be said to be healthy, with the exception of a few spots south of the Tagus and near Setubal, where malaria and fever prevail. The climate is, in general, milder and more agreeable than in Spain, owing to the height of the mountains and the great extent of the coast. Portugal was formerly a favourite health resort, and seems likely to become so again. Rain is very abundant in the west; and near Santarem, in the spring of 1864, the plains were flooded, and many villages inundated, and a great amount of property destroyed. Snow is rare in the south, but falls heavily on the mountains of the north provinces; it lies permanently on Mount Gaviarra (Minho), 7865 feet above the sea. Earthquakes occur frequently in the south, and in the vicinity of Lisbon. The soil in the valleys is rich, but husbandry is still very backward. The cultivation of the vine is the most important branch of industry, and the produce of the vineyards on the upper Douro, termed *port*, is the staple export; but the vine has suffered terribly in modern times from the attacks of the Phylloxera. Wheat, maize, barley, oats, flax, and hemp are cultivated in the elevated tracts; rice in the lowlands; olives, oranges, lemons, citrons, figs, and almonds, in the central and southern districts; and at the southern extremity the American aloe, the date, and other tropical plants flourish. The olive oil is of inferior quality. Cattle and sheep are reared in considerable numbers; the wool is generally rather coarse, but some of it equals that of the Spanish merinoes in fineness. Pigs and goats are also numerous. As in the south of Europe generally, horses are little used—oxen being employed for draught, and mules and asses as beasts of burden. The rearing of bees and silkworms is on the increase. The wild animals comprise the wolf, boar, goat, and deer; and among birds, the partridge, and the eagle in the mountains. The sea along the coasts and the rivers abound with fish, which is a great article of food with all classes. Dry fish also is imported to meet the demand arising from the number of saints' days. There are extensive forests of oak in the north, chestnut in the centre, and sea-pine, kermes, and cork in the south. There is abundant evidence that mining operations were carried on in Portugal by the Romans, but until quite recently the riches of the country in this respect were comparatively neglected. The mines produce copper, lead, tin, antimony, manganese, iron, anthracite, and lignite. Sea salt is collected by evaporation in various places. The manufactures are coarse woollen cloths in Alentejo and Beira; linens in Minho, Beira, and Tras os Montes; silks at Campo Grande, near Lisbon, and also at Oporto and Braganza; arms and jewelry at Lisbon and Oporto. There are glass-works at Marinha Grande; paper manufactories at Alemquer, Lisbon, and Guimaraens; potteries at Lisbon, Oporto, Coimbra, Beja, Estremoz, and Caldes; cotton manufactories at Alcobaca and Thomar; and tanneries in various parts.

In almost all the great branches of industry, whether mining, agricultural, or manufacturing, the country formerly lagged behind every other European state; but there now seems to be signs of improvement. Absenteeism is gradually becoming less universal; machinery and engineering processes are slowly but surely revolutionizing the system of culture hitherto pursued; agricultural schools and model farms are spreading the knowledge of scientific farming; an admirable treatise on rural economy has been adopted in the public schools; the primeval plough, which was of the roughest description, is being supplanted by French and American models. Fresh oliveyards are being laid down, improved methods of wine-making are adopted, the culture of the mulberry tree and the breeding of silkworms are assuming an important development in the north, and improved breeds of horses and oxen are introduced.

There are scarcely any good harbours, and until very recent years Portugal was entirely without tolerable means of internal communication, except for short distances in the neighbourhood of the two chief cities, Lisbon and Oporto. The length of railways open for traffic in 1886 was 1000 miles, of which only 200 are worked by the state. Telegraph lines are rapidly spreading over the whole country. Internal communication is being promoted by the construction of numerous excellent roads, though where the railway has not penetrated the means of public conveyance are still rather antiquated. Travellers move from place to place on mules, on horses, or in sedan chairs suspended between the animals. Canals being unknown, heavy goods are conveyed in bullock carts and the lighter on mules' or even men's backs. Navigation by the rivers can scarcely be said to exist, except on the Douro, where, however, it is obstructed by rocks, sandbanks, and the rapid current; and on the lower course of the Tagus, which is ascended up to a little above Lisbon by the largest merchant vessels and men-of-war.

Area, Population, &c.—Portugal is divided into six provinces, the area and population of which, according to the latest census, of 1878, are as follows:—

Provinces.	Area, Sq. Miles.	Population.
Minho, . . .	2671	982,785
Tras-os-Montes, .	4065	393,279
Beira, Upper, . .	8586	1,323,134
Beira, Lower, . .		
Estremadura, . .	8834	911,922
Alentejo, . . .	10,255	850,108
Algarve, . . .	2099	199,142
Total,	36,510	4,160,315

To the kingdom belong likewise the AZORES or Western Islands, the CAPE VERDE ISLANDS, and MADEIRA. Although of small extent the Cape Verde Islands are estimated the most important possession of Portugal, both politically and commercially. Placed as they are in the direct route of steamers bound to Brazil, and the west coast of South America generally, they are of great value as affording a convenient resting-place for coaling and renewing provisions and water. St. Vincent, the chief island, has an excellent harbour. Besides the preceding there are several Portuguese colonies in Asia and Africa, having a total estimated population of about 3,800,000.

Portugal has comparatively few large towns, the only places with more than 20,000 inhabitants being LISBON and OPORTO.

In the fifteenth century this country is stated to have had about 5,000,000 inhabitants. According to a calculation of 1732 the number was 1,850,000 at that period. Since then, and particularly since the commencement of the present century, the population has been gradually increasing.

The Portuguese are a handsome people, with regular features, olive complexion, and dark eyes. They are of the same lineage as the Spaniards, but have become more mixed, and their language—though originally the same—now contains many words and expressions, supposed to have been derived from Northern Africa, of which there are no traces in the Spanish. Since their attempt to annihilate the independence of Portugal the Spaniards have been regarded with inveterate hatred and jealousy. The moral character of the Portuguese has often been unfavourably represented, but probably if an impartial estimate could be made they would not be found worse than other people.

Constitution and Government.—The fundamental law of the kingdom is the Carta de Ley, granted by King Pedro IV., 29th April, 1826, and altered by additional Acts in 1852 and 1878. The crown is hereditary in the female as well as male line, but with preference of the male in case of equal birthright. The constitution recognizes three powers in the state, the legislative, executive, and “moderating” authority, the two last of which reside in the sovereign and his responsible ministers (seven form the cabinet). There are two legislative chambers, the Camara dos Pares, or House of Peers, and the Camara dos Deputados, or House of Commons, which are conjunctively called the General Cortes. The peers, unlimited in number, but actually numbering 150, are named for life by the sovereign, who also nominates the president and vice-president of the First Chamber. The peerage was formerly hereditary in certain families, but on 27th May, 1864, the Cortes passed a law abolishing hereditary succession. The members of the Second Chamber are chosen in direct election, by all citizens possessing a clear annual income of 133 milreis, or £22, or heads of families. Continental Portugal is divided into 94 electoral districts, returning 149 deputies, including Madeira and the Azores. Each deputy has a salary of about 10s. a day during the session. The annual session lasts three months, and fresh elections must take place at the end of every four years. The sovereign has no veto on a law passed twice by both Houses. All laws relating to finance and general taxation must originate in the Chamber of Deputies. The sovereign is permitted, in important cases, to take the advice of a council or state, or privy council, consisting of thirteen ordinary and three extraordinary members, nominated by the crown for life, and generally including the leading ministers, past and present. Great abuses are said to exist in the administration of justice, the inadequacy of the salaries leading to bribery. Capital punishment was abolished in 1867.

Church and Education.—The Roman Catholic faith is the state religion, but all other forms of worship are tolerated. The Portuguese church is under the special jurisdiction of a patriarch, with extensive powers, two archbishops, and fourteen bishops. The patriarch of Lisbon is always a cardinal, and to some extent, independent of Rome. All the conventual establishments were suppressed by decree of 28th May, 1834. A library of 30,000 volumes was set up at the former convent of San Francisco, at Lisbon, from the collections of books and manuscripts at the various monasteries. A few religious establishments are still permitted to exist, but their inmates are in a state of great poverty, and the buildings are gradually falling to ruin. The lower ranks of the priesthood are poorly educated, and their income scarcely removes them from the social sphere of the peasants and labouring classes. The number of Protestants in Portugal, mostly foreigners, does not exceed 500. They worship in chapels at Lisbon and Oporto.

The superintendence of public instruction is confided to a superior council of education, at whose head is the secretary of state for the home department, and which holds its sitting at Coimbra. Public education is entirely free

from the supervision and control of the church. The capital contains numerous and extensive libraries and educational institutions, but elsewhere they are very rare. By a law enacted in 1864 it is compulsory on parents to send their children to a place of public instruction; but this prescription is far from being enforced, and only a very small fraction of the children of the middle and lower classes really attend school. Portugal is one of the worst educated countries in Europe.

Revenue and Expenditure.—The annual revenue of Portugal amounted, on the average of the last ten years, to £6,000,000 sterling, while the average expenditure during the same period was about £750,000 more than that sum. In 1886 the estimated revenue from all sources, excluding loans, was £6,972,998, and the deficit was estimated at £419,369. There has been no budget for the last thirty years without a deficit. The public debt is now nearly £110,000,000. The annual interest amounts to over £8,000,000, and it has frequently remained unpaid.

Army and Navy.—The army of the kingdom is formed partly by conscription, and partly by voluntary enlistment. Its organization is based on a law of 1864, modified by subsequent laws in 1868, 1869, 1875, 1877, and 1884. All young men of twenty-one years of age, with certain exceptions, are obliged to serve. The effective is fixed annually by the Cortes. By the law of 1884 the army consists of twenty-four regiments of infantry, twelve regiments of chasseurs, ten regiments of cavalry, three regiments of mounted artillery, one brigade of mountain artillery, one regiment and four companies of garrison artillery, and one regiment of engineers. The duration of service is twelve years, three with the active army, five in the first, and four in the second reserve. The war effective is 120,000 men. The navy of Portugal is composed of thirty steamers and thirteen sailing vessels.

Trade and Commerce.—The commercial relations of Portugal are largely with Great Britain, although there has been a decrease in recent years, both in imports and exports; they each form about 45 per cent. of the total. The subjoined table gives the total value of the trade between Portugal and the United Kingdom:—

Years.	Exports to the United Kingdom.	Imports.
1883,	£3,461,922 ..	£1,962,184
1884,	3,039,155 ..	1,969,112
1885,	2,669,755 ..	1,740,430

Wine is the chief article of import from Portugal into the United Kingdom, the average quantity being about 3,000,000 gallons per annum, of the value of £1,000,000. The alcoholic strength of this wine is generally much higher than that of wines from France and other countries, and it consequently becomes chargeable with a higher duty. As Great Britain declines to relax its alcoholic scale of duties specially in favour of Portuguese wines, Portugal loads British goods with a heavy differential duty. The exports chiefly consist of cotton, iron, and woollen goods. The principal imports from Portugal, besides wine, are cattle, cork, olive oil, oranges, and lemons.

Colonies.—The formerly numerous colonies of the Portuguese in Asia are now reduced to Goa, Salcete, Damão, Macao, and settlements in the islands Sodor, Timor, and Miudoro. In Africa Portugal retains the governments of Angola and Congo in South Guinea, Mozambique on the eastern coast, and some establishments in Senegambia, with various islands. By the terms of a law passed by the Cortes in 1858, domestic slavery came to an end, nominally, in all the Portuguese colonies and settlements on the 29th of April, 1878.

History.—The early history of Portugal was involved in that of the larger part of the peninsula, and Portugal, under the Roman Empire, was included in the province of Lusitania.

[See SPAIN.] On the decline of the Roman power, when Spain was inundated by the Germanic tribes, Portugal shared in the general devastation; and when, at the beginning of the eighth century, the torrent of Arabian conquest spread over the peninsula, the territories and towns of Portugal were as easily subdued as the remainder of Spain. In the ninth century the greater part of Northern Portugal was wrested from the Mohammedans, and became subject to local governors dependent on the counts of Galicia.

In 1094 Alfonso VI. of Castile rewarded a Burgundian knight for great valour with the hand of his daughter and the government of Portugal. This first count of Portugal was Henry, great grandson of King Robert of France. His son Alfonso was the first king of Portugal. He assumed the regal dignity in 1139, after a brilliant victory over the Moors on the plains of Ourique. The house of Burgundy, thus begun, continued to reign over the country for 240 years, during which continual conquests enlarged the country to the dimensions it holds to this day. Lisbon was taken from the Moors in 1147, and at once became the capital. The sovereigns in that and the next following century were Sancho I., son, *el povoador*, the founder (1185–1211), Alfonso II., son (1211–23), Sancho II., son (1223–48), Alfonso III., brother (1248–79), Denis or Dionysius, son (1279–1325). The last was the king who cultivated internal progress, founded universities, and promoted the prosperity of the country won by his predecessors.

The kings of Portugal in the next two centuries were—Alfonso IV., son (1325–57), who murdered his wife, Inês de Castro, in 1314. Pedro I., son (1367–67), Fernando I., son (1367–83), Joam (John) I., son of Pedro (1383–1433), Duarte (Gaward), son (1433–38), Alfonso V., son (1438–81), Joam II., son (1481–95), Emmanuel, cousin (1495–1521). The first three of these sovereigns were engaged in frequent wars against the kings of Castile. In 1383 the male line of the Burgundian princes became extinct in Portugal by the death of Fernando I.; and Dom Joam, an illegitimate son of Pedro I., and grand master of the order of Avis, became king. Joam was an able and a successful prince; and under his auspices the geographical expeditions of the Portuguese commenced. He married Philippa, the daughter of the celebrated John of Gaunt, duke of Lancaster. In his reign the Portuguese achieved some important African conquests, and seized upon Madeira and the Canary Islands. Alfonso II. and Joam II. likewise promoted discoveries on the coasts of Africa, which were still further extended under Emmanuel, by the expedition of Vasco da Gama to India in 1500, and the Indian viceroyalty of the great Albuquerque.

The kings of Portugal in the sixteenth and seventeenth centuries were—Joam III., son (1521–57), Sebastian, grandson (1557–78), Enrique, a cardinal, son of Emmanuel (1578–80), Philip II., III., and IV. of Spain (1580–1640) followed. The Portuguese sovereigns recommenced with Joam IV. (1640–56), Alfonso VI., son (1656–83); Pedro II., brother (1683–1707) followed. During the sixteenth century the introduction of the Inquisition and the Jesuits into Portugal quenched the liberal spirit which had before prevailed to some extent; and the death of Enrique, by placing the Portuguese crown for sixty years in the hands of Spain, made Portugal a mere province of that country. The house of Braganza assumed the crown under Joam IV., on the country flaming into rebellion at the injustice of the Spanish rule. John of Braganza was the direct heir of the house of Avis through his grandmother. Philip II. of Spain was a usurper to the prejudice of that princess.

The eighteenth century began with the reign of Joam V., son of Pedro II. (1707–50). He was followed by his son Joseph, whose reign was rendered fatally memorable by the earthquake of Lisbon (1755). This king had a bitter quarrel with the Jesuits; their expulsion by him led to a

complete breach with Rome for fully ten years. Joseph was succeeded by his brother Pedro III., but the real authority was vested in his daughter Maria Francisca, the first queen who ever reigned over Portugal. The joint reign of Maria and her uncle was from 1777 to 1786, when Pedro died; and from the latter year the queen reigned alone. In 1792 Maria's brain gave way and her son Dom Joam, prince of Brazil, was appointed regent; he was afterwards Joam VI. The regent joined the rest of Europe in proclaiming war against the new French republic. The ultimate result was a treaty between the Emperor Napoleon, when France had fallen into his hands, and his puppet on the crown of Spain, for the part of Portugal, and General Junot was sent to take possession of the country. The French occupation, in 1807, led at once to Portugal receiving the protection of England. Junot was compelled to submit to the convention of Cintra, and to retire with dishonour (1808). A second French invasion under Soult (1809) and a third under Massena (1810) followed. Wellington's victories drove Soult away, and his obstinate defence of the lines of Torres Vedras ruined Massena. Finally, at Fuentes d'Onore, on the Spanish frontier, a glorious British victory in 1811 freed the soil of Portugal for ever from its French invaders, and the war passed into Spain. In 1816 the queen died in Portugal, which she had refused to leave, and her son succeeded formally to the throne.

Anarchy and invasion had, however, left its mark. The king had been in Brazil since 1808, when he fled before the French; he refused to return to the disturbed mother-country. In 1820 the first of a long series of revolutions broke out; universal suffrage was declared, and an embassy sent to Brazil to acquaint the king with the fact. He granted a constitution (1820), and as soon as Portugal had grown quiet he even ventured to return. But Brazil now clamoured for independence. Joam VI. had left his son Pedro as regent of that kingdom. He felt as unable to retain by force, as he was by sentiment, the allegiance of that great dependency; its independence, declared in 1822, was finally acknowledged by Portugal in 1825, and Prince Pedro became its first sovereign with the title of emperor. At the death of Joam VI. the Emperor Pedro claimed the crown, but only to resign it to his daughter Maria da Gloria, who was accordingly declared queen. Her uncle Miguel usurped the crown in 1828, and the queen fled to Brazil. Maria was restored in 1833 after a sanguinary civil war, which was only terminated by the arrival of the queen and her father Dom Pedro, who had abdicated the crown of Brazil and now came to secure that of his daughter for her. It proved an uneasy and disturbed possession. At the queen's death her young son Pedro V. quietly succeeded, however, under the regency of his father, the king-consort (1853). Harmony now began to return, and the little kingdom developed its internal resources apace. Pedro V. died of fever when only twenty-four (1861) and was succeeded by his brother Dom Luis, who in the following year married Maria Pia, daughter of Vittorio Emmanuele, first king of Italy. In 1886 his eldest son was married to the Princess Anélie d'Orléans, daughter of the Comte de Paris, the head of the Orleans family of France.

Language and Literature.—The language of Portugal, like those of other kingdoms in the peninsula, originated in a mixture of the Latin, Teutonic, and Arabic. The separation of Portugal from Spain, their wars, and the little commercial intercourse which existed between them during the middle ages, combined in course of time to make the Portuguese a different language. The Spanish, like the Portuguese, has many words borrowed from the Arabic. Their wars with the Moors of Africa and the Mohammedans of India in the fifteenth century introduced into it many others from the languages spoken in those countries. As a conversational language, the Portuguese is considered

superior to the Spanish. It is more concise, easy, and simple, but not so rich. The pronunciation is difficult for a foreigner, more particularly the nasal sounds, in which it abounds. The gutturals, however, are neither so strong nor so common as in the Spanish.

The literature of Portugal is complete without being very rich. In all branches there have been happy attempts; in none is there an abundance, except in lyric and bucolic poetry, in both which branches the Portuguese are richer than their neighbours of the peninsula. Poetry comprises the most important part of their literature; prose and eloquence have been very little cultivated, owing to the intolerance of the government and the persecutions of the Inquisition. After the fifteenth century poetry in Portugal became and remained bombastic and affected, and its ancient power and natural grace were completely lost. In the time of Louis XIV. the French were copied, and many Gallicisms were admitted. Under Pombal, Portuguese literature revived, and poets strove to give elevation to the language. Prose, too, became more simple and pure by the imitation of the classics. This minister was the first who banished the scholastic logic and metaphysics from the lecture-rooms of Coimbra. The study of the ancient languages was always and still continues to be neglected.

Among the most distinguished poets of Portugal, given in chronological order, are—Gonzalo Hermiguez, Egaz Moñiz, King Denis, the authors of the "Cancelheiros Geraes," Bernardim Ribeyro, Christovão Falcão, Jorge de Montemayor, Saa de Miranda, Antonio Ferreira, Jeronymo Cortereal Diego Bernaldez, Pedro de Andrade Caminha, and above all others, Luys de Camões, whose poem "Os Lusíadas," has been translated into every language of Europe.

At no period did historical composition in Portugal attain the elevation which it reached in Spain. The ancient chronicles are fewer, and not so well written; there is little or no local history, and as to a general narrative embracing all the events and political transactions of that kingdom, the Portuguese possess none but the incomplete work of Brito. As might be expected, the events of India formed the favourite theme of many of the Portuguese historians of the sixteenth century.

With the sixteenth century the brilliant period of Portuguese literature passed away, while the connection with Spain, and the influence produced at the beginning of the seventeenth century by the fantastic school of the Gongoristas, almost entirely naturalized Spanish literature in Portugal.

The English language has adopted some very curious modifications of Portuguese words, of which the following are the chief:—*Casfe*, the Portuguese *casta*, claste, i.e. of pure birth; *cocoa*, more properly *coco*, the nut, not the bean, whence the well-known beverage is derived (which latter is indeed *cacao*, and of Mexican origin), the Portuguese for hobgoblin, a name due to the curious hobgoblin's face which the three holes make at the root of the nut; *commodore*, the Portuguese version of commander; *fetich*, for Portuguese *feitiço*, sorcery; *marmalade*, originally limited to quince-preserve, the Portuguese for quince being *marmelo*; *palaver*, Portuguese for the Greek *parabolé*, our parable, in the sense of talk, &c.

PORTUGAL LAUREL. See CERASUS.

PORTUGUESE MAN-OF-WAR (*Physalia utriculus*) is a name given to a species of HYDROZOA belonging to the group Siphonophora. It is an inhabitant of tropical seas, and is sometimes thrown on European coasts. The Portuguese man-of-war is one of those remarkable colonies of organisms common in the Hydrozoa. The most conspicuous portion is a large coloured bladder-like float, beneath which are arranged individuals with exclusively nutritive functions, and others with reproductive functions, as well as numerous long tentacles.

PORTULACÆÆ is an order of plants belonging to the group **THALAMIFLOREÆ**. The species are herbs or shrubs, often succulent, with entire, often fleshy, alternate or opposite leaves. The flowers are hermaphrodite, usually regular and solitary. The sepals are usually two, rarely five, free or adnate to the base of the ovary; the petals are usually five, rarely wanting, readily dropping off; the stamens are usually perigynous, fewer than the petals, equal to them or indefinite. The ovary is free or half inferior, one-celled, with a style divided at the top into two or three stigmas. The fruit is a capsule, usually dehiscent. About 125 species are known, found in most parts of the world, the majority being American. Most of the species are mucilaginous, some having been employed medicinally on account of their astringency. The Common PURSLANE (*Portulaca oleracea*) is used both as a potherb and medicinally.

POSEIDON, in the Greek mythology, was the great god of the sea—that is, the Mediterranean Sea, not the Atlantic Ocean, which last was the realm of Okeanos. Poseidôn was brother of Zeus, Hêra, Hêadês, and Dêmêtêr, all of them children of the supreme god of the Titans, Kronos. In the casting of lots to apportion the rule of the universe, the sea fell to Poseidôn. Even Zeus himself was not much more powerful than this dread divinity. His power to hurl the thundering waves upon the coast gained him his favourite epithet of "the earth-shaker," and as the Greeks saw in waves a likeness to prancing horses, with tossing crests, Poseidôn was also frequently called "the tamer of horses," and was held to be the patron of those noble animals. He was even credited with their creation; for the myth ran that he and Athena contended for the patronage of Athens by seeing which of them could produce the most useful thing to the new city. The god created the horse; the goddess the olive, and gained the city.

The myths surrounding Poseidôn are interesting. He was at the right hand of Zeus in the conflicts of the gods for supremacy, he helped to subdue the Giants, and overthrew the Kentaurs. He married a daughter of Okeanos, Amphitritê, who bore him Triton and other children, but was not very faithful to her—type of the inconstancy of the element he ruled. His revenge on Minos for defrauding him of a sacrifice took a vicarious form: he drove Pasiphaë (the daughter of MINOS) mad with a frantic passion for a bull. Hence came the Minotaur, and the great legend of Theseus, told elsewhere. Poseidôn assisted Apollo to build the walls of the earliest city of Troy for Laomedôn, who cheated the gods of the stipulated reward. Hence, in the war of Troy, both gods were bitterly against the Trojans. Nevertheless, he was cruel to Odusseus, who was so often in his power; and when the hero killed the giant Poluphêmos, one of the many illegitimate children of Poseidôn, the god took a fierce revenge, and the long wandering was lengthened and embittered.

Poseidôn is represented with flowing hair and beard; venerable, majestic, and powerful in aspect, he holds the trident with which he renders the earth and rouses the sea to fury, he rides on a dolphin or is accompanied by one, or he is drawn by fiery horses in a chariot. Sea nymphs and goddesses form a numerous court of attendants. The festival of the Panionia was held in his honour.

POSEIDONIA. See **PÆSTUM**.

POSEN (in Polish *Poznań*), a town of Germany, the capital of a province of the same name, situated in a sandy tract on the left bank of the Wartha, is a strongly fortified city, with a population of 65,713. The town has three suburbs and four gates, and is now one of the pleasantest and best built places in Prussia. The chief public buildings are—the castle, situated on an eminence, numerous Roman Catholic churches, the most remarkable of which are the Cathedral and the Church of St. Stanislaus, the

latter being a masterpiece of Italian architecture; two Protestant churches, a Greek chapel, a synagogue, the archiepiscopal palace, the theatre, the chief guard-house, the town-hall, &c. Posen is the residence of the Catholic archbishop of Posen and Gnesen, and of the governor of the province. The manufactures consist of chintz, calico, tobacco, leather, woollen cloth, ticking, senling-wax, and carriages. There are likewise breweries, distilleries, &c. It has a good trade in corn, hemp, flax, tobacco, and hops, and three annual fairs, is 160 miles E. from Berlin and 100 from Frankfort-on-the-Oder, and is connected with Stettin by railway. Posen is one of the most ancient Polish towns, having been the residence of the kings of Poland down to 1296. It was also important as a great depot of the trade between Germany and the East, and was a member of the Hanseatic League in the middle ages. The new part of the town has been erected since it came into the possession of Prussia in 1815.

POSILIPPO, a mountain in the north-west of Naples, composed of volcanic tufa, famous for its tunnel, known as the *Grotta di Pozzuoli* or *di Posilipo*, running nearly from east to west, and extending 757 yards in length by 21 to 32 feet in breadth. Its height is unequal, varying from 25 feet in the centre to 69 feet at the eastern entrance. It is said to have been built in the reign of Tiberius.

POSITIVE and **POR'TATIVE ORGANS**, antique terms applied to the mediæval church-organs. The first were stationary, as for instance over the west door; the second were movable, and followed the choir to whichever altar was being served. There are only large portative organs (no positive one at all) in St. Peter's at Rome to this day. Very small portative organs were called **REGALS**. As in many churches the positive organ was stationed in the choir, the term *positive* grew to mean what we now term *choir-organ*, i.e. a second manual of softer stops than the chief manual or "great organ" contains, in an instrument of two or of three rows of keys; and though the term is now obsolete with us, the French term for choir-organ is still *clavier de positif*.

POSITIVISM, or the Religion of Humanity, is the name given by the French philosopher, Auguste Comte, to the system of thought and conduct founded by him, and signifies that it rests on a basis of demonstrable, or "positive," science. The name has been objected to as being ungainly, and as connoting the idea of dogmatism. To the first of these objections, although perhaps superficially true, it may be replied that every system has a fair claim to be recognized by the appellation bestowed on it by its founder; and this is especially the case where a man like Comte is concerned. Positivists also assert that the other objection, expressing the idea that their creed leans towards intellectual autocracy, can be maintained only so long as ignorance of its real nature prevails. In addition to the qualities of *reality*, *utility*, *certainty*, and *precision*, which are connected in ordinary language with the term *positive*, Comte points out that, when science was applied to the study of social phenomena, it at once assumed an *organic* character, and that, being organic, it necessarily became *relative*. It could not, however, become relative without becoming also *sympathetic*, and it is this last quality which, although usually regarded as having no connection with science, Comte declares to be specially typical of Positivism.

In his famous **LAW of Intellectual Progress**, without a reference to which even the briefest account of Positivism would be imperfect, Comte asserts that every theoretical conception framed by the human mind passes through three stages [see **COMTE, AUGUSTE**]; the first being the theological or fictitious; the second, the metaphysical or abstract; the third, the positive or scientific. The first of these stages is always provisional, the second simply transitional, the third alone definitive. It would be out of place in an

article like the present to discuss the truth of this law, which can be adequately appreciated only after a study of Comte's Philosophy of History; but it may be mentioned that it has been accepted by various thinkers of eminence, and notably by John Stuart Mill. Supposing it to be true, it involves, ultimately, the universal abandonment of every form of theological belief—that is to say, the decay of every religion resting on a supernatural foundation. Religion, however, as suggested by its etymological derivation, is the binding force of all human society, and by no writer has this been more clearly recognized than by Comte. It is religion which, under one form or another, holds society together. In order, therefore, that the social fabric may not, as a result of intellectual progress, be dissolved and anarchy supervene, it is necessary to discover some substitute for theological religion. Science must become religious. Positivism, then, professes to be such a religion. It is ostensibly based on science, and, in Comte's view, is, in its general principles at least, if not in all its details, destined ultimately to become universal.

The fundamental problem of human life, as stated by Comte, is how to subordinate Egoism to Altruism—or, to put it in a simpler though less compact form, how to give continually-increasing predominance to the higher over the lower side of man's nature, so that his activity, which originally was inspired by necessarily individualist motives, may become ever more and more social in its character. This is a problem which, it is almost needless to say, although not explicitly recognized, has been empirically dealt with by every religion in its turn, and in some cases with remarkable success; but, owing to what Positivism regards as the fatal want of *reality* in their doctrines, it was impossible that the success could be other than temporary. These creeds, whatever their differences in dogmatic details, all inculcated in man's mind a spirit of reverence and submission to some supernatural power or powers, which were supposed to exercise absolute dominion over his destiny, and from which he derived all that he possessed. As a collateral and subordinate result they also, through the wisdom of their teachers, the spiritual leaders of the race, fostered the sense of duty and desire for union among those whose lives were subject to the same conditions, and who acknowledged allegiance to the same Divine Power. This was done, no doubt, in a very rudimentary and imperfect way at first, but every fresh religious development, while becoming simpler in its supernatural aspect, strengthened the social ties, until Christianity, by its doctrine that all men were children of one Father, and consequently brethren, carried the conviction of the unity of the race to a point which had never before been reached, thereby approximating more closely than any previous creed to a solution of the problem.

Assuming, however, the truth of the Positivist hypothesis as to the disappearance of theological belief, a substitute is required for the supernatural Power which has served not merely as the rallying-point of man's intellectual conceptions, but as the source of inspiration of his social sympathies. This substitute Positivism finds in Humanity, whom, following out a suggestion of Pascal, it personifies as an immense and eternal being, to whose immeasurable services we are indebted for all the blessings we enjoy, and whose existence, apart altogether from disputed theological legends of origin, is, at all events, an indisputable fact.

It is not unusual to speak of Positivism as if it were a mere *a priori* emanation from Comte's brain—as if he had undertaken the task of reconstructing society merely to correspond with his own prejudices and conceptions as to the form it ought to take; and he has accordingly been taxed with arrogance and presumption. But to regard Positivism in this light is to mistake its character and its aims. It is, in theory, a scientific construction, framed in accordance with what Comte regarded as permanent and

incontrovertible laws governing the world and man, and cannot, therefore, justly be condemned as a mere arbitrary scheme for which Comte alone is responsible. How far its claim in this respect is well-founded is, of course, open to question, and no one was more sensible than Comte of the difficulties which lay in the way of its general acceptance. He was fully aware of the tentative nature of his task; but, while acknowledging the possibility that shortcomings might ultimately be detected in his *doctrines*, he insisted strenuously on the virtue of his *method*. "In all inquiries," he said, "but especially in the study of social questions, the method is more important than the doctrine;" and in more than one passage of his fundamental work, the "Philosophie Positive," he admitted, in a spirit of modesty widely separated from the arrogance laid to his charge, that different conclusions from his own might be arrived at by "more fortunate successors," employing his method, but possessed of later, and therefore more accurate, information. The tendency to agree with him that social, like all other phenomena, are subject to the action of natural law, is certainly increasing. Whether the system he built up on this assumption will ultimately secure the adhesion of mankind, is a question which only the future can decide.

Although, however, Positivism puts forward these scientific pretensions, it has by no means the dry, cold character with which it is sometimes reproached, and which is popularly attributed to all science. Its cardinal principle is the supremacy of feeling over intellect, and this principle is fostered in every way by the conception of Humanity, by the cultivation of a sense of gratitude to the past, by a touching attitude of reverence towards the dead, by insisting on the sacredness of family ties, by exalting the functions of woman as a wife and a mother, and by the most elaborate provisions for what Comte called *culte*—a French word which has, perhaps, no adequate equivalent in English, but is more or less imperfectly rendered by the word "worship," and which, as employed by Comte, has for its object to enforce the idea, not merely of the *solidarity*, but—what is far more important—the *continuity* of the human race, an idea which lay at the root of Carlyle's "Hero Worship." "The History of the World," said Carlyle, "is the Biography of Great Men," and he knew of "no nobler feeling" than "the transcendent admiration of a Great Man," to which he gave the name of worship. Comte, with whom, not merely on this but on some other points, Carlyle had much in common, gave a more universal and systematic form to this conception by his remarkable compilation of the "Positivist Calendar," which, with the double view of cultivating a knowledge of the history of the past, and stimulating our gratitude for the legacy it has bequeathed to us, devotes each day in the year to the memory of some benefactor of the race—some great man who, whether as priest or warrior, poet or statesman, thinker or worker, aided, by his efforts, the great cause of human progress. Carlyle justifies hero-worship by asking whether every "true man" does not feel "that he is himself made higher by doing reverence to what is really above him;" and this question is some index to the spirit which animates Positivism. It urges its adherents to endeavour to understand the past, as a means of raising their own characters. It seeks to repress the tendency, so widely manifest in the present generation, to glorify itself at the expense of its ancestors, and to substitute for it a spirit of humility, springing from a more thorough knowledge of the extent of our obligations; in reference to which, indeed, it affirms, in one of its most characteristic axioms, that, with the lapse of time, *the living become ever more and more subject to the dominion of the dead*, and that therefore, in adopting an attitude of irreverence towards the past, we are vainly striving to escape from an inevitable destiny.

As a further means of subordinating the individual to

the community, and therefore to Humanity, Positivism seeks to break down the barrier which now exists between private and public life, by means of a series of social ceremonies, to which Comte gave the name of Sacraments, and which are intended to remind each member of a community that, in all the important epochs of his career—e.g., birth, marriage, death—his interests are not exclusive, but that he forms part of a greater whole which is also concerned. This view of life has been sanctioned by all previous creeds, although expressed under theological forms, and Positivism merely continues the tradition.

By these and similar means it endeavours to assert the supremacy of feeling over intellect, and to stimulate the sentiment of social duty—duty to Humanity. But according to the wise phrase of Tacitus, which has been so often repeated, the difficulty is not merely to do our duty, but to know what is our duty; and here the assistance of the intellect is necessary. Such knowledge is to be obtained only by education directed to social ends; and perhaps the most important part of Comte's work is his comprehensive scheme for the reform of education, which, if carried out, would mean a veritable revolution, not merely in the methods of teaching, but in social habits and modes of life. To this scheme any but the most meagre reference is impossible here. The magnitude, however, of the changes it contemplates is faintly indicated by the provision that schools, as now understood, would be abolished, all children being left in their mother's care till the age of fourteen, and receiving from her the rudiments of education which they are now taught at school. This, however, is merely a preliminary process, it being proposed that, at the age of fourteen, the children of all classes, and both sexes, shall commence an encyclopædic training, founded on Comte's Classification of the Sciences [see COMTE, AUGUSTE], which is intended to give them a general acquaintance with the whole field of human knowledge, from mathematics to morals, and will occupy them for seven years. This education is to be imparted by an organized body of teachers, whom Comte designates by the name of a priesthood—a term which, especially in Protestant countries, is invested with certain sinister associations, and the employment of which accounts, no doubt, for the suspicion with which many people view Positivism, under the impression that, if once established, it would be dangerous to liberty. Of the existence of this feeling Comte was quite aware, but his survey of history led him to the conclusion, which he formulates as a definite sociological theory—that *no society can exist, and be developed, without a priesthood in some form or other*. "All men," he said, "stand in need of education and counsel," and wherever any institution is found to exercise these functions, there, under whatever name it is known, exists what is in essence a priesthood. In this sense the germ of a Positivist priesthood has already made its appearance, although in a very imperfect form. The science teacher, the physician, the journalist, each in his own way, performs these functions, and may consequently, within his own limits, be regarded as a priest. Comte, therefore, desired that what is now done in a spontaneous, informal way, with too often no guarantee of either capacity or integrity, should be done by a carefully selected body of men, trained for the purpose, devoting their whole lives to the work, and voluntarily abandoning all competition for wealth or exalted position.

But education, in the Positivist sense, must not be regarded as limited to mere book-learning. Its object, as already stated, is to inculcate principles of civic duty—to make men not merely scholars, but citizens; the education which allows any member of the community to stand aloof from the political and social movements of his time, however elaborate it may be from the intellectual stand-point, being, in Comte's view, utterly unworthy of the name. Obviously, however, the character of civic duty is governed

by the conception which exists as to the nature and functions of the state; and here, again, Positivism sets forth an ideal which, if established, would effect a revolution. With the decay of theology, it regards as inevitable the decline of the hereditary principle in government; the institution of birth being directly dependent on theology. On this hypothesis, the ultimate form of government will be republican. War also, being regarded as another ally of theology, it is assumed will disappear. If, in fact, the Positivist estimate be correct, there are spontaneous tendencies now at work, by which society will ultimately be transformed—which will, by degrees, abolish the theological, monarchical, and military character it still possesses, and render it instead scientific, republican, and pacific—industrial. Abandoning, as Positivism does, all idea of a future life, and of consolation in another world for the misfortunes of this, it considers the highest duty of the human race to be that of developing, by collective efforts, the resources of the earth, its only dwelling-place, so that, by the labours of each succeeding generation, the happiness of its inhabitants may be increased. With the acceptance of this view many of the special classes identified with, and supported by, existing institutions will gradually become extinct, and society, in the main, will assume a purely industrial aspect, the bulk of it consisting of workmen, labouring as now, only under vastly improved conditions, and with more avowedly social aims, in association with a comparatively small body of capitalists, regarded as trustees of the wealth of the community, under the intellectual and moral guidance of the priesthood, and inspired and consoled by the companionship and sympathy of women.

Industry, however, being the basis of the society to which Positivism looks forward, and peace being ever more and more firmly established, Comte predicts that the communities into which mankind is now distributed will, by degrees, undergo a process of re-arrangement. There are, in his view, three normal forms of human association—three social aggregates which call out man's affection, and inspire him with a sense of duty—the family, the state, and humanity. Of these, the spirit of union is most intense in the case of the first, and most general in the case of the last; the state serving as a connecting-link between the two—appealing to man's sympathy and energies on behalf of something nobler than the interests of the narrow family group, and so helping to raise him to a consciousness of his duty to humanity. In order, however, that this process should be effective, the idea of country should be real and tangible. Patriotism, in the proper sense of the term, Comte holds to be impossible in the case of such enormous societies as those now constituting the principal states of the world. They are too large to inspire a genuine sentiment of affection and devotion, and he regards it, therefore, as certain that, sooner or later, a movement of decomposition will set in, which will reduce them within narrower limits. The ideal Positivist state, the state destined to become universal, is represented by a city with its surrounding territory; and Comte anticipates that, under the influence of this view, Europe will in time break up into a number of small republics of the size of Belgium or Tuscany, in which civic duty, now too often a synonym for mere vulgar chauvinism, will become a reality, modified, restricted, and ennobled by subordination to the still loftier sentiment of duty to humanity.

It will be seen that the aims of Positivism are large, and it is consequently regarded with hostility by many who are ignorant of its teaching, or who shrink from its conclusions. It is sometimes classed indiscriminately with Atheism, Communism, and other theories of a purely revolutionary character; and if attention be directed only to the results which it proclaims as inevitable, and for which it seeks to prepare the way, this comparison is perhaps not unnatural. Between Positivism, however, and

other so-called "Progressive" schools, there is a profound difference in method, which is too often overlooked. While they mostly look to political changes, either peaceful or violent, as a means of achieving their ends, Positivism relies solely on moral means. It insists that a reformation in ideas must precede any alteration in institutions. One of the most pregnant and luminous political maxims with which Comte has enriched the world consists in this—that *progress is but the development of order*, and that, unless based upon order, progress of any permanent character is impossible. Although, therefore, the intellectual, moral, and political aspects of society will, in the course of time, if the Positivist ideal be reached, undergo modifications, of which the most advanced reformers now scarcely dream, yet it is assumed that they will be effected gradually and spontaneously, as the result of previous convictions arrived at by means of Positivist education. Briefly, the method of Positivism may be described as that of evolution as opposed to revolution.

Whether the Religion of Humanity be destined to justify its title, time alone can show. Its success or its failure can mutter nothing to its founder. The philosopher to whose genius it is due, who passed his life in poverty and obscurity, gaining a precarious subsistence as a teacher of mathematics, now sleeps peacefully, indifferent alike to praise or blame, in a quiet hollow of Père-Lachaise. It is, however, a significant testimony to the force of his doctrines, that, in various parts of the world, they have succeeded in attracting groups of devoted adherents, of different nationalities, who carry on a systematic propaganda. The influence of his teaching, moreover, cannot be measured by the number of those who call themselves Positivists. In Comte's phrase, Positivism is "systematized common sense," and, as such, it acts, naturally enough, in different ways on different minds, influencing them to an extent which it is quite impossible to gauge. Persons of the most widely different pursuits, although unable to accept it as a whole, and even rejecting its leading principles, have acknowledged their obligations to it on points connected with their own special experience.

The centre of the Positivist movement is at No. 10 Rue Monsieur-le-Prince, Paris, where M. Pierre Lafitte, the friend and disciple of Auguste Comte, assisted by a body of younger co-religionists, carries on the work of scientific and historical teaching essential to the progress of the cause, and where also a Positivist magazine, *La Revue Occidentale*, is published every two months. There are also groups in Havre, Rouen, and other French cities. Positivism was introduced into England by Dr. Richard Congreve, another disciple of Comte, and there are now three organized bodies in London, the best known, perhaps, of which has its headquarters at Newton Hall, Fleur-de-lis Court, Fetter Lane. The movement has of late years spread to Liverpool, Manchester, Birmingham, and other British cities. It has also branches in Sweden, the United States, Chili, Brazil, India, &c. The organization is not very strict, and there are differences of opinion as to the opportuneness of giving prominence to certain aspects of the system, but, by common consent, an agreement exists on fundamental points of doctrine. All the groups cherish the same ideal, although some of them differ as to the means of arriving at it.

Comte's principal work, "*La Politique Positive*," instituting the Religion of Humanity, has been translated into English, and is published in four volumes by Longmans. Two of his smaller works are also translated—the "*Catechism of Positive Religion*" (Trübner), and the "*General View of Positivism*" (Reeves and Turner). An English abridgment, by Miss Martineau, of the "*Philosophie Positive*" is published by Trübner in two volumes. An appreciative memoir, with some account of the system, will be found in the second volume of Lewes's "*History of Phi-*

losophy." A fuller and more synthetic view, however, is given in the "*Notice sur l'Œuvre et sur la Vie d'Auguste Comte*," by Dr. Robinet, his friend and physician.

POSSE COMITATUS (literally the power of a county) comprises all able-bodied males within the county between the ages of fifteen and seventy years. All such persons are bound to aid the sheriff in all matters that relate to his office; and he is fainable if he neglect to avail himself of their aid. In case of any invasion, rebellion, riot, &c., or breach of the peace within the county, all such persons, on pain of fine or imprisonment, are bound to attend him on being charged by him to do so, and to assist in opposing and suppressing the rioters, &c. The Posse Comitatus may come armed, and are justified in killing a person in case of resistance. They may also be raised when necessary for the purpose of apprehending traitors, felons, &c., and that even within particular franchises. It is lawful for any peace-officer, and perhaps even a private person, to raise a competent number of people for the purpose of opposing and suppressing enemies, rebels, rioters, &c., within the county; but all such persons are punishable if they use unnecessary violence or create false alarms. It is also the duty of the sheriff, or any minister of the king who has the execution of the king's writs, or process even of a civil nature, who meets with actual resistance in his attempt to execute them, to raise a power sufficient to quell the resistance.

POSSET, a drink made by the mixture of milk with some curdling and acidulous preparation, such as white wine, sherry, or ale. The milk is boiled, and while in a state of ebullition the acidulous liquor is added. A good posset, to induce perspiration, if taken at bedtime, may be compounded by the addition of a table-spoonful of treacle to about half a pint of milk.

POST-OBIT BOND (Lat. *post obitum*, after death), a bond given for the purpose of securing a sum of money, the condition of which is, that the money shall be paid on the death of some person. Though generally usurious arrangements, they can be legally enforced.

POST OFFICE. The name of this important institution is evidently derived from the Latin *positum* (placed, fixed), and it came into use in the first instance in connection with the posts maintained at intervals along the great military roads of the Roman Empire, where couriers were kept in readiness to convey imperial edicts and governmental messages from hand to hand. By methods of this kind communication was maintained between the imperial city and its most distant provinces; and though in the earliest times no provision was made for the conveyance of private messages and letters, there can be little doubt that either openly or secretly the government messengers would often be employed to convey private letters in addition to the official documents. From the works of MARCO POLO we learn that under the rule of the great khan an elaborate system of postal arrangements was maintained throughout his huge empire for the transmission of messages of state, and the ancient Peruvian kingdom, when it was discovered by the Spaniards, included a regular postal organization, among other developments of its strange civilization. After the break up of the old Roman Empire posts in Europe fell for a long time into disuse, and with the exception of some temporary arrangements for the maintenance of couriers, made by Charlemagne about 807, the earliest provision for a letter-post that we can find arose in connection with the Hanse towns in the early part of the thirteenth century. At the same period the University of Paris organized a postal service for the use of its teachers and students, which lasted in a measure for over 500 years, being only abolished in 1719; and the example of Paris was followed during the thirteenth and fourteenth centuries by many of the universities and commercial institutions of Europe. In the sixteenth century a line

of letter-posts connecting Austria with Lombardy, and another between Vienna and Brussels, were established by the counts of Thurm and Taxis, and members of this family greatly extended and improved the postal arrangements of the German Empire during subsequent years, receiving in return for their services special privileges and rights, some of which they retained up to the present century.

In England during the mediæval period only the business of the state demanded correspondence, and this was conveyed by royal messengers variously styled *cokinus*, *garcio*, or *nuncios*, some posts for their accommodation being in existence as early as the reign of King John. Entries of payments of nunci for the carriage of letters may be found on the Close and Missal Rolls during the reign of John, and these payments may be traced in an almost unbroken series through the records of subsequent reigns. Nuncios also formed part of the establishment of the more powerful nobles. In 1481 Edward IV., during the Scottish war, is stated by Gale to have established at certain posts, 20 miles apart, a change of riders, who handed letters to one another, and by this means conveyed them 200 miles in two days; but this was only a temporary expedient, and was not maintained after the special circumstances which had called it into existence had passed away. It appears that in England the posts, at which relays of riders and horses were kept, were at first wholly private enterprises, but when their importance became felt and appreciated the state found it both politic and profitable to subject them to its surveillance. During the reign of Henry VIII. Sir Brian Tuke was appointed in 1533 to the office of Master of the Postes both in England and in other parts of the king's dominions beyond seas, his duties being the adequate furnishing and maintenance of post horses; and a statute in 1584 (2 & 3 Edward VI. c. 3) fixed a penny a mile as the rate to be chargeable for the hire of post horses. Further regulations were afterwards made by royal proclamation and orders in council, and some improvements were introduced during the latter part of the reign of Elizabeth. It was at this period that a dispute arose as to the management of the Strangers' or Foreign Post, which the immigrant Flemings had established in England, and the dispute being referred to the government for settlement, the latter assumed control of the business and established the principle that the superintendence of the foreign as well as the domestic mails of England should be intrusted to an Englishman. The master of posts was thus raised to the dignity of chief postmaster, the first person to hold the dignity being Thomas Randolph (1581). The closer connection established between England and Scotland by the accession of James I., and the commencement of the influx of Scotchmen into England, led to great improvements in the postal arrangements. In 1685 a proclamation was made "for settling of the letter office of England and Scotland." It sets forth "that there hath been no certain or constant intercourse between the kingdoms of England and Scotland," and commands Thomas Witherings, Esq., his Majesty's postmaster of England for foreign parts, to settle a running post or two, to run night and day between Edinburgh and the city of London, to go thither and come back in six days. Directions are given for the management of the correspondence between post-towns on the line of road and other towns which are named, and likewise in Ireland. An attempt of the Common Council of London to set up a separate post office in 1649 was checked by a resolution of the House of Commons, which declared that the office of postmaster is and ought to be in the sole power and disposal of Parliament. The monopoly thus established has been preserved in all the subsequent regulations of the post office. At this time the rates of postage were fixed at 2d. for a single letter for a distance less than 80 miles, 4d. up to 140 miles, 6d.

for any longer distance in England, and 8d. to any place in Scotland. The most complete step which had been taken up to that time in the establishment of a post office was in 1657, under the protectorate of Cromwell, when an Act was passed to settle the postage between England, Scotland, and Ireland. It has been the model of all subsequent measures on the subject. It enacted that "there shall be one general post office, and one officer, styled the Postmaster-general of England and Comptroller of the post office." All other persons were strictly forbidden to "set up or employ any foot posts, horse posts, or packet boats." A tariff was arranged for all letters—English, Irish, Scotch, and foreign. This Act was confirmed in the first year of the Restoration. In 1681 a penny post was established for the city of London and its suburbs. The privilege of franking letters also began about this time, and, notwithstanding its many abuses, continued in operation, though modified from time to time, until 1840. In 1695 the Scottish Parliament passed an Act for the establishment of a Scotch post office, but for a long time both the English and Scotch Parliaments had to put forth their utmost power, with very partial success, to secure the London and Edinburgh mails from robbery, especially in the wild "Border" country. Packets sailed between England and Ireland as early as the reign of Elizabeth, but it was not until the close of the seventeenth century that the Irish post became a matter of any importance. What may be called a Post Office Consolidation Act was passed in the reign of Queen Anne; it provided for the establishment of a general post and letter office in London, and of chief offices in Edinburgh, Dublin, New York, and other "convenient places in her Majesty's colonies of America;" all to be placed under the control of an officer, "to be made and constituted by letters patent, under the Great Seal, by the name and style of her Majesty's Postmaster-general." The tariff was again revised, and 1d. extra added to some of the rates previously established. The principle was to charge according to the distance which the conveyance travelled, and not the actual distance between places. A single letter was interpreted to mean a single piece of paper, provided it did not exceed an ounce in weight. A second piece of paper, or any inclosure however small, constituted a double letter. A single sheet above an ounce was charged with fourfold postage. In 1720 the system of cross-posts (posts from country places to the main routes) was reconstructed with great success by Ralph Allen, the postmaster at Bath; and in 1784 the greatest reform effected in the conveyance of letters, until the era of railways and penny postage, was accomplished by the introduction of swift and guarded mail coaches. This was principally due to Mr. John Palmer, manager of the Bath and Bristol theatres, supported by Mr. Pitt. The first mail coach left London for Bristol, 2nd August, 1784. The scheme was for a long time strongly resisted by the post-office authorities; but a very short trial showed that it greatly increased the punctuality, speed, and security of the post, and added very largely to the revenue. In 1766 the penny post was established for the city of Edinburgh and its environs, and in 1794 the London district post was improved and raised to 2d.

The effect of an improved service for the delivery of letters resulted in a rapid increase of business, and the net revenue rose from £196,500 in 1784 to about £1,600,000 in 1815–16, beyond which it did not greatly advance for the next twenty years. To have kept pace with the increase of population the amount ought to have gone up about £500,000 a year, and this circumstance among some others caused Rowland Hill to study closely the working of the post office with a view to effect an improvement. The result of his investigations was published in a pamphlet entitled "Post Office Reform," in 1837, and his plan

at once attracted the attention of Parliament and the nation. Its principal features were, (1) the abolition of franking; (2) increased speed in the delivery of letters; (3) more frequent opportunities for their despatch; (4) the introduction of a greatly reduced and uniform rate of postage, which should be made without regard to distance should be charged by weight, and for which payment should be made in advance. The latter he proposed should be one penny for each half ounce for all letters and other papers, whether single or multiple, forming one packet; heavier packets, to any convenient limit, being charged an additional penny for each additional half ounce. The plan, like most other reforms, was at first strenuously opposed by the authorities, but the public sympathies were strongly excited in its favour, and a Parliamentary committee was obtained on the subject in 1838. After sitting upwards of sixty-three days, and examining Mr. Hill and eighty-three other witnesses, besides the officers of the department, the committee presented a most elaborate report in favour of the whole plan; and in the following year a bill to enable the government to carry it into effect was passed in the House of Commons by a majority of 100, and the measure became law on 17th August, 1839. Mr. Hill was appropriately selected by the government to superintend the working of the measure, and on 5th December, 1839, the first step was taken in the reduction of the rate by the lowering of the London district postage to 1*d.* and the general inland postage to 4*d.* the half ounce. This measure continued in force only five weeks, and on 10th January, 1840, a uniform inland rate of postage of 1*d.* per half ounce, payable in advance, or 2*d.* on delivery, came into operation. On this day Parliamentary franking entirely ceased. On 1st May, 1840, stamped letter paper, envelopes embellished with an allegorical design by Mulready,

and adhesive postage stamps were issued, and the public preference for the latter soon caused them to become the only method used by the department, with the exception of the stamped envelope, which came into use soon afterwards.

The new plan having been introduced over the heads of the post-office authorities, was regarded at first with profound mistrust, and it also happened that it was instituted at a period of severe commercial depression; but the benefits which the new system conferred upon the public were so unmistakable that very soon opposition died out, and the system became firmly established. The business transacted by the department was enormously increased by the change, for during the first year the increase of letters was in the ratio of 122·25 per cent., and the second year showed an increase of 16 per cent. over the first, and during the next ten years the average increase was about 6 per cent. per annum. Every year, however, witnessed important improvements in, and rapid enlargements of, our postal system, and these have been continued up to the present time, with the result that for varied operations and general extent of business it is unequalled by that of any other country in the world.

Of these improvements perhaps the more important were—(1) the introduction of postal savings banks by Mr. Gladstone as chancellor of the exchequer in 1861; (2) the transfer to the state of the telegraph service in 1870; (3) the introduction of the halfpenny post card in October, 1870; and (4) the establishment of a parcel post in 1883.

The following table gives statistics of the number of letters delivered in the United Kingdom from 1839, the last complete year of the dear postage, to 1886. Those years are reckoned as ending 31st December until 1876, and thereafter the financial year ending 31st March.

Year ending 31st December 1876, and thereafter the Financial Year ending 31st March	Total in England and Wales.	per ce annum.	Numb Person	Total in Scotland.	per cent each	Total in Ireland.	crease per ce per annum.	Total in United Kingdom.	Increase per cent per annum.	Average Number to each Person.
Estimated No. Letters, 1839,	60,000,000			8,000,000		8,000,000	—	76,000,000	—	{ 3
" " Frank's,	5,172,000			380,000		1,055,000	—	6,563,000	—	{ 7
" " Letters, 1810,	132,000,000	120-0		19,000,000	143-5	18,000,000	119-2	169,000,000	22-2	{ 5
Aver. Five Years, 1841-45,	179,000,000	10-2		24,000,000	9-2	24,000,000	9-5	227,000,000	10-0	{ 7
" " " 1846-50,	259,000,000	5-2		34,000,000	4-2	34,000,000	5-0	327,000,000	5-0	{ 12
" " " 1851-55,	330,000,000	6-0		41,000,000	5-2	39,000,000	3-5	410,000,000	5-7	{ 15
" " " 1856-60,	427,000,000	4-5		51,000,000	3-2	45,000,000	3-0	523,000,000	4-2	{ 18
" " " 1861-65,	534,000,000	5-7		61,000,000	0-5	53,000,000	3-2	648,000,000	5-5	{ 22
" " " 1866-70,	664,000,000	4-0		76,000,000		60,000,000	3-2	800,000,000	4-0	{ 26
Year, 1871,	721,000,000	2-5		80,000,000		66,000,000	3-0	867,000,000	2-3	{ 27
" " " " 1875,	846,852,000	5-3		90,976,400	0-9	70,563,300	0-8	1,008,392,100	4-6	{ 31
" " " " 1879-80,	950,111,800	3-0		101,948,300	3-0	75,937,400	—	1,127,997,500	2-8	{ 33
" " " " 1880-81,	961,372,000	3-3		104,085,200	3-0	78,790,700	3-8	1,165,166,900	3-3	{ 34
" " " " 1881-82,	1,037,316,700	5-7		109,790,900	4-6	82,238,200	4-4	1,220,354,800	5-5	{ 35
" " " " 1882-83,	1,077,647,200	3-0		116,500,800		86,479,200	5-2	1,280,636,200	4-2	{ 36
" " " " 1883-84,	1,112,192,200	3-2		122,204,800		87,689,900	1-4	1,322,088,500	3-2	{ 37
" " " " 1884-85,	1,148,329,200	3-2		122,945,400		89,065,400	1-6	1,360,341,400	2-9	{ 38
" " " " 1885-86,	1,187,381,000	3-4		126,445,300	2-8	90,727,700	0-7	1,409,547,900	3-2	{ 39

Among the minor changes which have contributed to the development of the business of the post office during recent years may be mentioned the reductions made in the rates in 1870 and subsequently. In 1870 the impressed stamp on newspapers was abolished and a $\frac{1}{2}d.$ adhesive stamp for all newspapers up to 6 oz. in weight was substituted, and circular letters, when not inclosed in envelopes, were also transmitted at $\frac{1}{2}d.$ At the same time the charge upon book packets, patterns, and samples was reckoned at $\frac{1}{2}d.$ for each 2 oz., instead of 1*d.* for each 4 oz. In 1872 the postage for inland letters was reduced to 1*d.* for 1 oz., 1*½d.* for 2 oz., and an additional $\frac{1}{2}d.$ for every 2 oz. up to 12. Important reductions were made also as opportunity offered in the rates for foreign and colonial postage, and the result

was followed in the majority of cases by such a large increase of business that the way was prepared for the important Postal Union arranged between the chief European nations in 1874 by a congress held at Bern. By the terms of the latter agreement a uniform rate, wholly irrespective of distance, of 2½d. for each letter not exceeding half an ounce in weight, was established between the countries within the Union, uniform rates for newspapers, samples, and book parcels being also agreed upon. The operations of the Union were extended at the next congress, held at Paris in 1878, and provision was made for the calling of a similar meeting every five years for the purpose of a periodical revision of rates and rules. The last congress was held at Lisbon in February, 1885. Notwithstanding

these additional and very liberal facilities which have been granted to the public, the following table will show that the post office is still a very profitable business. We may, in the first place, mention that the revenue in 1838, the last year before the general reduction in postage took place, was £2,846,278:—

REVENUE and EXPENDITURE on account of Postage and Money Orders in recent years.

Year.	Total Postal Revenue.	Total cost of Post-office Service.	Net Revenue.
1880-81	£0,733,427	£1,135,659	£2,597,768
1881-82	7,027,600	4,286,596	2,741,004
1882-83	7,300,960	4,545,398	2,755,562
1883-84	7,764,855	5,154,829	2,610,026
1884-85	7,906,406	5,317,213	2,589,193
1885-86	8,170,604	5,486,724	2,683,880

The revenue included, in 1885-86, £7,886,898 from letters, parcels, post cards, newspapers, and books; £280,106 commission on money and postal orders; and £3600 from unclaimed money orders. The expenditure included £4,828,523 for the postal service, including the money-order and postal-order business; and £658,201 for packet service.

The statistics of post cards, book packets, and newspapers delivered in the United Kingdom in different years from 1872, stands thus:—

Year.	Number.	Increase per cent. per annum.
POST CARDS.		
1872, .	76,000,000	
1875, .	87,116,800	9.7
1878-79,	111,445,700	9.0
1885-86,	171,290,000	6.9
BOOK PACKETS AND CIRCULARS.		
1872, .	114,000,000	...
1875, .	158,666,600	11.7
1878-79,	197,076,500	4.1
1885-86,	342,207,400	6.8
NEWSPAPERS.		
1872, .	109,000,000	
1875, .	121,049,400	3.4
1878-79,	130,895,300	
1885-86,	147,721,100	2.8

The post-office authorities publish quarterly the *British Postal Guide*, which is sold at 6d. per copy, and which contains the fullest particulars as to the rates of postage, &c., the despatch of mails, the post offices of the United Kingdom, and other matters. A Post-office Handbook is also sold at one penny at all post-offices, and contains all the principal postal regulations in a small compass. The following are the chief regulations at present:—

Inland Letters.—The rates of postage are 1d. for a letter weighing not more than 1 oz.; exceeding 1 oz. but under 2 oz., 1½d.; and a ¾d. additional for every 2 oz. or part of 2 oz. beyond. No letter may exceed 18 inches in length, 9 in width, or 6 in depth. Unpaid letters are charged double rates on delivery.

Colonial and Foreign Letters.—The rates for these are various, and are given in the *Guide*, but all the European countries, Turkey, Egypt, Persia, Canada, Newfoundland, and the United States of America are comprised

in the first-class of the postal union, and for these there is a uniform rate for letters of 2½d. per half ounce; 1d. for a post card; and 2d. for a reply ditto; a halfpenny for a newspaper per 2 oz.; and a halfpenny for each 2 oz. of any packet of printed papers.

Registration.—The system of registered letters, on which an extra fee is prepaid, does not guarantee their safe delivery, and the postmaster-general is legally protected against responsibility for the safe delivery of registered articles. But the transmission of such letters is made more secure by the system of receipt which enables them to be traced from their receipt to their delivery, and the postmaster-general now undertakes to make good the contents of a registered article lost while passing through the post to the extent of £2, subject to certain conditions. In 1874 registration was rendered compulsory in the case of watches, jewelry, coin, &c., transmitted through the post, and where such articles are sent unregistered, the department exacts a fee of 8d. in addition to the regular postage. In 1878 a strong inducement to registration was offered by the reduction of the fee from 4d. to 2d. In Belgium, and some other parts of the Continent, registered letters can be insured up to a large sum—a premium of 2s. 3d. insuring as much value as £500.

Newspapers.—Newspapers with an impressed stamp were formerly transmitted and retransmitted free by the post to any part of the kingdom for fifteen days after date of publication. This privilege was often abused, and in 1870 the impressed stamp was abolished; a halfpenny adhesive stamp for all newspapers up to 6 oz. in weight was substituted, a fresh postage being charged for each transmission. Although the prepaid postage upon every inland newspaper is one halfpenny, a packet containing two or more registered newspapers is not liable to a higher rate than the book-postage upon it would be.

Book Post.—The greatest improvement effected in the post office after the adoption of the penny post was the system of book post, which was introduced in 1848, and improved in 1855 and in 1857 and 1870. It has been found of the greatest convenience, more especially to publishers, editors, and printers. Formerly the rate was 1d. for every 4 oz. or fraction of that weight, but in 1870 a system was introduced, chiefly through the advocacy of Mr. Graves, M.P. for Liverpool, of charging all book packets at the rate of one halfpenny for every 2 oz. in weight. In all cases the postage must be prepaid by stamps affixed. If postage is not prepaid it is charged at double rate, and if partially paid double the deficiency. No packet must exceed 5 lbs. in weight, 18 inches in length, 9 in width, or 6 in depth, unless it be sent to or from a government office, and any cover must be open at the ends or sides so as to admit of inspection. A packet may contain any number of separate books or other publications, such as prints or maps, and any quantity of paper, parchment, or vellum; and the books or other publications may be either printed, written, or plain, or any mixture of the three. The only restriction is that nothing in manuscript shall bear the character of a private epistolary communication. The book post has been extended to all the colonies and to some foreign countries.

Parcel Post.—This branch of post-office work dates only from 1st August, 1883, and it owes its introduction chiefly to the zeal and ability of the Right Hon. Henry Fawcett, M.P., postmaster-general from 1880 to 1884. As early as 1698 Docwra, the inventor of the penny post for London, had arranged for the transmission of small parcels, but the high rates of postage afterwards suppressed the carriage of everything except letters. A scheme for a parcel post was contemplated by Sir Rowland Hill, but it never came to maturity, and though other plans were afterwards brought forward by other authorities, and negotiations were opened with the railway companies by Lord John

Manners in 1878, it was not until 1882 that the matter was brought to a practical conclusion. It was not at the outset a financial success, the number of parcels transmitted being less than had been anticipated, and the average weight, and consequently the payment for postage, being below the estimate. Certain simplifications and consequent economies have been introduced, and a steady increase in the number of parcels carried has been observed. The number during the first month was only at the rate of 15,000,000 per annum, but the results obtained between the 1st of April, 1885, and the 31st of March, 1886, showed that 26,417,422 parcels had been posted in the United Kingdom at an average postage of 5·38d. each, of which 2·72d. went to the railway companies. Parcels not exceeding 11 lbs. in weight, 3 feet 6 inches in length, or 6 feet in length and girth combined, are received at any post office for transmission between places in the United Kingdom. The rates of postage are—for a parcel not exceeding 1 lb. in weight, 3d., and 1½d. for every additional pound or part of a pound. No parcel is accepted which weighs more than 11 lbs., and the postage must in all cases be paid in advance. At higher rates parcels may now be sent to the British colonies and foreign possessions, and also to many foreign countries.

Money and Postal Orders.—So long ago as 1792 a money order office was established in connection with the post office to enable soldiers and sailors to transmit their earnings, and it was afterwards opened to the general public, but the rates of commission were so high that it was comparatively little used. It is now a separate branch of the establishment, and is, in fact, a vast banking concern dealing with sums too minute to be profitable for private banks. In 1880 the system of *Postal Orders* was introduced, by which greater facilities were offered to the public for the transmission of small sums, and these are now issued for certain fixed sums from 1s. up to £1, the poundage charged being, for notes of 1s. and 1s. 6d., ½d.; 2s. to 10s. 6d., 1d.; 15s. to £1, 1½d. Broken amounts may be made up by the use of postage stamps not exceeding 5d. in value affixed to the face of any one postal order. These orders may be crossed the same as cheques, and when crossed payment is only made through a banker. They are current for three months, and after that period they become liable to another commission. The result of the introduction of Postal Orders has naturally been a great decrease in Money Orders, on which the commission is higher, as they involve more trouble. The number of Money Orders fell from an average of 17,000,000 in the years preceding 1880 to 10,358,000 in 1885–86, whilst the Postal Order business developed with great rapidity, the number issued having increased from 18,881,164 in 1884–85 to 25,790,360 (valued at £7,885,347) in 1885–86.

Post-office Savings Banks.—The institution of post-office savings banks was first practically suggested by Mr. Charles William Sykes, of Huddersfield, in the year 1860, and the suggestion being accepted and effectually worked out by Mr. Gladstone, the then chancellor of the exchequer, an Act to enable the department to undertake the business was obtained early in 1861, and was brought into operation on the 16th September of that year. In February, 1862, the Act was brought into operation both in Scotland and Ireland, and within two years nearly all the money-order offices became savings banks as well. The business was most successful from the outset, and at the end of 1868, 819,669 accounts had been opened with an aggregate deposit of £3,377,480. By the end of 1873 the number of accounts open was 1,555,645, the aggregate deposit, including interest, being £21,167,749. Since then every year has displayed an increase in the amount of business transacted, and the returns for the year ending 31st December, 1885, showed that the number of depositors had increased to 8,585,650, and the aggregate deposit to

£47,697,838. The smallest amount received at the post-office banks was originally fixed at one shilling, and this limit is still retained; but for the encouragement of habits of thrift among the young, a scheme devised by Mr. Chetwynd, a receiver and accountant-general of the post office, was introduced by Mr. Fawcett, by which blank slips are issued free at every post office, which may be filled up with twelve penny stamps and then received at the savings bank as a shilling deposit. The plan was first tried experimentally in certain selected districts in September, 1880, and its success was so immediate that on 15th November it was extended to the whole country. In less than six months 576,500 slips were received and 223,000 new accounts opened. The amount received by the post office is limited to £30 in any one year ending the 31st December, this sum being reckoned independently of the sums withdrawn during that period; and the total limit of a deposit is fixed at £150 in all, exclusive of interest. A further limit is imposed of £200 for the total sum which, inclusive of interest, may stand to the credit of a depositor, and after this amount is reached interest ceases. From time to time attempts have been made by the post-office authorities to extend these limits, but up to the present the opposition of the banking interest has proved too powerful.

Investment and Sales of Government Stock.—By virtue of an Act passed in 1880 under the ministry of Mr. Gladstone, the post-office savings banks were made available for purchases and sales of small amounts of government stock, and this now represents an important and growing branch of their business. Any depositor having sufficient to his credit may send his deposit book to the controller of the savings bank department with a form of application for investment in the consolidated, reduced, new 3, 2½, and 2½ per cent. stocks. The sum invested must not be less than £10, or the amount of the current price of £10 stock with the addition of the commission, and not more than £100 stock can be credited to an account in any year ending the 31st of December, or £300 stock in all. For the purpose of an immediate investment in government stock, a deposit to an amount not exceeding the value of £100 stock with the commission may be made in one year ending the 31st of December, irrespective of the limits for ordinary deposits. The stock thus purchased is represented to the depositor by the issue of an investment certificate, the dividends being credited to his account as they become due, and the stock can be sold through the department in any amount not less than £10, by the investor sending in his application to the controller, with his deposit book and stock certificate. The number of investment accounts open 31st December, 1885 was 30,597, and the amount of stock standing to their credit was £2,452,252.

Returned Letters.—When every attempt to discover the person for whom a letter, post card, or parcel has failed, it is forwarded to the "dead" letter office, in order that it may be returned to the sender, provided any clue can be obtained as to his or her whereabouts. A strong staff of officers are now employed in this duty alone, and no less than 5,626,875 letters, 628,579 post cards, 5,164,983 book packets, 472,269 newspapers, and 45,150 parcels passed through their hands in 1885. Of these the great majority were either re-issued to corrected addressees or returned to the senders. As a curious statistical fact it may be stated that every year many thousand letters are posted without any address at all. These are of course at once sent to this office. The number so posted in the United Kingdom in 1885 was 26,472, of which 1686 contained value to the total amount of £3898. Of the total number of letters which find their way to the returned letter office, about 60,000 contain property of various kinds, the value of their contents being on an average £3,000,000. Of course the bulk of this sum is forwarded to the senders; but when their address cannot

be discovered the contents become the property of the crown.

The number of post-offices in the United Kingdom in 1885-86 was 16,805, of which 920 were head offices. Of this number 371 had been added during the year. During the same period 860 collecting boxes had also been set up, bringing the total number of receptacles of all sorts of letters up to about 34,280. In every report of the postmaster-general we find mention of an increase in the number of "free deliveries" in rural districts. Every town of the least importance has now two deliveries daily, many have three, some four, five, six, and even seven. London and its suburbs are divided into nine postal districts, indicated by the eight points of the compass, in addition to the east and west central districts. In each of the nine districts there is a chief sorting office, which has a direct postal communication with the chief office of every other district, and with every post town in the kingdom. Letters arriving at these offices are separated into letter-carriers' walks, and immediately distributed. In many of these walks there are hourly deliveries of letters, into which deliveries those letters fall that are continually flowing into the metropolis from provincial towns, and from foreign mails landed at the outposts throughout the day. There are over 650 letter-carriers for the first morning delivery in London, carrying as many bags into the different districts of the metropolis. Liverpool has also been divided into districts, and so successful has the plan proved that it is being gradually extended to other large towns.

To facilitate despatch, shortly after the introduction of railways, the plan of sorting during the journey was adopted. The system has gradually been much improved, and by an ingenious contrivance letter bags are now taken and deposited at many stations without stopping the train. Of late years the sorting of letters, &c., during the journey has been extended to the steam packets employed in the foreign mail service. This is one of the most expensive departments of the post office, and is very far from being remunerative in a pecuniary view. Formerly this branch of postal business was under the admiralty, but was transferred to the post-office authorities in 1860.

The Post Office and the Telegraphs.—In addition to the previous extension of the post-office system, already noticed, in 1870 the department purchased and undertook the control of all the telegraphs in the United Kingdom. As early as 1861 Mr. Scudamore, one of the secretaries to the post office, and who may be said to have been the chief mover in the matter throughout, saw the advantage which would mutually ensue to the country and the public if the post office and telegraphs were combined under one management. For some years the scheme did not meet with much encouragement, but in 1868 the matter was taken up by the government, and after considerable opposition an Act was passed authorizing its adoption. The financial arrangements were not settled till the following year. The terms demanded by the old companies in the first instance were most extravagant and unreasonable, and though they were afterwards reduced by arbitration, the bargain finally concluded was very much to the advantage of the companies bought out. It was intended that the new system should come into operation on 1st January, 1870, but the post office did not actually commence it until 6th February. The transfer of the several telegraphic systems from their respective proprietaries to the government was effected for the purpose of simplifying and reducing the charges to the public; of extending the accommodation both in places already in possession of telegraph stations and to places left destitute, because not likely to be sufficiently profitable for private enterprise; of effecting a complete isolation of railway telegraphing from that required by the general business of the country; of introducing free trade in the

collection, and low rates for the transmission, of news for the press; and, generally, of enhancing efficiency. The enormous increase of business which immediately commenced when government undertook the telegraphs rendered increased accommodation necessary at the central office in London. A very large commodious building was therefore erected, and to this all the telegraphic business was transferred in 1874. A brief comparison of some of the features of the former system with those of the present one will best show the advantages of the latter.

Under the old system a message of twenty words, within the United Kingdom, cost from 1s. to 6s. 8d., according to distance. At 460 railway stations an extra 6d. was charged for the behoof of the station-master. At 475 telegraph stations additional fees were charged for transmission over local system; and finally, when a message had to pass over the lines of two or more companies, each company exacted its full tariff. Now, the cost of a twelve word message is 6d., and each additional word is charged $\frac{1}{2}$ d., inclusive of portage to a distance of one mile from the receiving station, all over the United Kingdom. Previous to the transfer, telegraphic privileges were confined to paying centres, and competition for business necessarily resulted in the placing of stations close together. In Liverpool, for instance, the three companies had sixteen stations, three of which were within a few yards of the exchange, while the population served with twelve money-order offices were outside the telegraphic free delivery. It has now more than forty offices instead of sixteen, and twenty-three out of the number serve outlying districts. In Manchester districts provided with seventeen post offices were beyond the free-delivery pale of the several companies; but now nearly all these offices are telegraphic receipt and despatch stations, thus effecting a great saving both in portage fees and time. The benefits conferred upon the rural population and the inhabitants of small towns were of a still more marked character. No private company would have found it worth while to establish a telegraphic office in every considerable village in the country, or to carry their wires into every portion of a town. The post office, having offices already established, and servants already engaged in all these places, undertakes the additional duty of despatching telegraphic messages at comparatively slight expense; and is thus able to follow its postal tradition, namely, to serve the greatest number of localities, recouping its losses in unpaying districts by the excess of profits in the paying districts. To protect the department, while pursuing this policy, from speculators who might choose to operate in the busier localities, government adopts the same monopoly as in letter-carrying, and the postmaster-general has the exclusive privilege of receiving, collecting, transmitting, and delivering telegraphic messages within the United Kingdom.

As regards arrangements for the press, the telegraph companies formerly shared the news monopoly among them. They had a reasonable enough scale of charges, but as to the quantity of news or the time in which it would be despatched there was no dependence. The government telegraphy leaves the news-collecting business free. Practically, the supply of news is in the hands of several news or press associations, which make their own arrangements with provincial papers, exchanges, reading-rooms, &c. All that the post office does is to receive and transmit intelligence at low rates, and with incredible despatch. Suppose a batch of news is arranged in an office near Temple Bar, how is it to be conveyed to Edinburgh, Exeter, Liverpool, Cardiff, &c., with the least possible delay? It is taken to the Temple Bar telegraph office, whence it is immediately transmitted by pneumatic tube to the central office in the city. The batch is brought to the counter set apart for the purpose, and divided in equal portions among three or four operators, to be transferred by punching to a ribbon

or tape of paper. These three can prepare the message for transmission fast enough for one Wheatstone automatic transmitter. One clerk can punch forty words a minute; but as one automatic instrument can transmit and record 150 words a minute, it takes three punches to fully employ one of these marvellous contrivances. As the tape is prepared it is passed through the transmitter; but what follows is a perfect triumph of organization. The tape is passed in rapid succession through three transmitters without any human interference; and these three instruments supply three circuits. On one circuit Birmingham, Manchester, and Liverpool are simultaneously supplied with the message on the tape. Almost at the same second the message is passing through the second instrument to supply Leeds, Nottingham, Sheffield, Newcastle, Edinburgh, and Glasgow. When the tape gets to the third transmitter it is on its way to Bristol, Cardiff, Newport, Exeter, and Plymouth. So that probably not fewer than twenty towns, and probably 100 newspapers, are being furnished with copies of the same message, all but simultaneously, at the rate of about 150 words a minute; for the arrangements at the receiving offices, it must be understood, correspond with those at the headquarters, and the copy is written "manifold," so that, on emergency, every folio of "flimsy," in duplicate or triplicate, may be sent off as soon as written to the waiting newspaper editors. Under the old system 173 papers were supplied with news; now over 600 are supplied. During the session of Parliament the companies used to send 6000 words daily; now the number is over 70,000, and as many as 500,000 are often despatched in a single night from the central office in London. Some newspapers have private wires, and indeed there are many thousand miles of so-called private wires, for which government gets a rent of £82,000 per annum. The highest number of messages sent by the companies in one year was 6,000,000; but in the first year after the transfer 10,000,000 were despatched; and in 1885-86 over 28,000,000.

Messages (with the necessary stamps affixed) may be deposited in pillar letter boxes, and the telegrams are despatched forthwith on their arrival with the letters at the postal telegraph office, without extra charge. Any person who has official duties connected with the post office, and who discloses or intercepts the contents of a telegraphic message, is guilty of a misdemeanour, and liable, upon conviction, to imprisonment for a term not exceeding a year.

When we turn, however, from considerations of increased convenience, reduced cost to the public, &c., to the financial results of the telegraph service, we find it is quite unremunerative, and, indeed, is carried on at a positive loss of considerable extent. Thus in 1885-86 the total revenue received by the telegraph department was £1,787,251, and the total cost of the service was £1,826,858, showing a loss of nearly £40,000, and this was reckoned independently of the sum of £326,417 for interest of capital, which ought also to be defrayed out of the returns. The excessive cost of the original purchase, the rapidity now attained by the letter post, and the competition of the telephones, are the chief reasons assigned for the unsatisfactory returns of the telegraph service, and there is good reason to anticipate that the latter element will press still more hardly in the future. By an arrangement made in 1884 private companies were allowed to establish telephone exchanges on the conditions of the payment of a royalty of 10 per cent, and of entering into an undertaking to deliver no written messages. The royalty paid by the companies in 1885-86 was £20,000, but this represented an enormously greater sum diverted from the telegraph revenue, and though the department itself had established twenty-seven telephone exchanges the greater part of the business remained in the hands of private companies.

The head of the post office, styled the postmaster-general,

until 1869 was almost invariably a peer, but the place can now be filled by a member of the House of Commons. Under his authority are placed all the offices in England and the colonies. The salary is £2500 a year. He is the only person connected with the establishment who leaves office on a change of government. The secretary, his responsible adviser, has a salary of £2000; there is a second secretary, at the same salary, who is also head of the telegraph department; and in 1874 a third secretary was appointed, specially to supervise the financial business. There are at the general post office in London various departments—principally for auditing all the accounts connected with the establishment, and exercising a general supervision over the whole kingdom. The London staff, including letter-carriers, numbers more than 10,000. There are secretaries' and similar departments to those of London, on a smaller scale, at Dublin and Edinburgh.

Miscellaneous Business.—In addition to the numerous duties already enumerated, the post office is the medium for the transaction of a large amount of business connected with the inland revenue. A number of small stamp duties may now be paid by the use of postage stamps, and other inland revenue and fee stamps may be obtained through all money-order offices, at which also documents may be left for stamping at Somerset House. Civil service, judicature fee, bankruptcy, patent, design, and trade-mark stamps, are also kept on sale at many of the head post offices of the principal towns, and where they are not kept in stock they may be obtained through money-order offices. The department also supplies dog, gun, and private brewer licenses, at all money-order offices in England and Scotland; male servants, carriages, and armorial bearings licenses at all money-order offices in England; game and gamekeepers' licenses at the London head district post-offices, and at some money-order offices in the provinces. Other important departments of post-office work are to be found in connection with insurance and the granting of annuities, but these have already been referred to under ANNUITIES, POST-OFFICE.

The necessary limits of our space will not permit us to glance at the important developments of postal service that have taken place in other countries during the present century, but in most of the great civilized nations the post-office arrangements are well conceived and diligently sustained. In many important features the British post office has been the first to open up the way, and at the present time in all points except minimum postage rates, where we are behind some other states, our system contrasts favourably with that of any foreign country. Every year applications for information are received by the postal authorities from foreign states as to the working of the various parts of our system, and among the many influences at work in the present day for the breaking up of national prejudices and for promoting unity of interests among the nations of the earth, a high place must be assigned to the service of the post office. As an illustration of this we may mention that during the year 1884-85 the savings bank branch alone attracted visits from the French Inspector-general of Postal Savings Banks, from a gentleman from Vienna, a delegate of the Argentine Republic, the postmaster-general of British Guiana, and a banker from Hong Kong. Applications for information were also received during the same year from the governments of Germany, Saxony, Switzerland, Italy, and the Hawaiian Archipelago, as well as from Victoria, Queensland, Cape Colony, Jamaica, and the Bahamas. As an illustration of the rapid spread of improvements it may also be mentioned that the method of saving by penny stamps, introduced by Mr. Fawcett at the end of 1880, has since then been generally adopted throughout Europe where postal savings banks are established, with beneficial results similar to those experienced in the United Kingdom.

See the *Report of the Postmaster-General* published annually; *The Postal Guide*, issued quarterly; "The Post-Office and Aids to Thrift," by Henry Fawcett (1881); and Lewin's "Her Majesty's Mails" (1864).

POSTE RESTANTE, a French expression which means that a letter is to be left at the post office until called for, a convenient method for persons travelling. In the United Kingdom letters so addressed are kept one month, and then returned to the writers through the dead-letter office. Residents are not allowed to use this address.

POST'ERN, in fortification, a small doorway opening through the flank of a bastion upon the moat or ditch, and designed to afford a secure means of egress for troops to relieve sentries, marching parties, and sallying detachments. It is sometimes called "the sally port."

POST-GLACIAL, in geology, the term applied to those superficial deposits formed during the latter part of the **PLEISTOCENE PERIOD**, immediately after the episode known as the Glacial Period. Employing the same nomenclature, the early Pleistocene formations are termed *Pre-glacial*, the middle Pleistocene being *Glacial*. See **GEOLOGY**.

POST'HORN, a straight brass horn, usually 4 feet long, much used by mail-coach guards, whence its name. The fundamental note (c) is not used; but the remaining notes are not difficult to produce. The usual "fanfare" of the posthorn is built upon variations of the chord of C, of which it contains the following notes, c' g' c'' e'' g'' c''', the last note (c''') above the treble stave) requiring an accomplished player to produce it.

POSTMASTER, the name formerly given to a person who let out horses and carriages for hire. The term arose at the time when letters were forwarded by means of relays of horses. [See **POST OFFICE**.] In Great Britain postmasters paid an annual license to the government, according to the number of horses and carriages they kept, until 1870. There is now no license, and the term postmaster may be considered obsolete; and as the horse duty was to a great extent abolished in 1874, every one who keeps a horse is at perfect liberty to let it for hire.

The term postmaster is now generally applied to the functionary who has the superintendence of a post office, and of whom there were in 1884-85 some 16,200 in the various post offices of the United Kingdom.

POST-PLIOCENE, in geology, a term occasionally applied to the **PLEISTOCENE PERIOD**, in allusion to the fact that this immediately succeeded the **PLIOCENE**.

POST-TERTIARY PERIOD. See **QUATERNARY**.

POSTULATE (Lat. *postulatum*) is a thing required to be granted, or the use of which in reasoning is demanded. The distinction between a postulate and an axiom lies in this—that the latter is admitted to be self-evident; while the former may be agreed upon between two reasoners and admitted by both, but not as a proposition which it would be impossible to deny. The postulates of Euclid have reference to certain constructions indispensable to the reasoning. Those of the earlier books are these three:—A straight line may be drawn from one point to another; a line already drawn may be produced; and a circle may be described from a given centre, with a given radius. The object of laying down these in the shape of demands, is that nothing shall be proceeded on, in the course of the reasoning, without being explicitly stated at the outset.

POSTUMIUS, the name of one of the great patrician *gentes* or clans of ancient Rome. The most famous family of the gens was that of Albus or Albinus; and there are few periods of republican Rome which are not made illustrious by a Postumius Albus. Thus, Antonius Postumius Albus was the dictator who won the battle of Lake Regillus, and founded the supremacy of Rome over Latium, B.C. 498. Spurius was one of the first decemvirs

(B.C. 451) and consul. Another Spurius was one of the two consuls who passed under the yoke at the Caudine Forks [see **PONTIUS**], and who honourably begged, but in vain, that he and others who had sworn to the peace with Pontius should be given up to the Samnites when Rome determined to dishonourably break that treaty. So the list continues down to Antonius Postumius Albinus, consul with Marcus Antonius the orator (grandfather of Mark Antony the triumvir) in B.C. 99. After this the family is not distinguished.

POTAMOGA'LE. See **RIVER-SHREW**.

POTAMOG'ETON. See **POND-WEED**.

POT'ASH. See **POTASSIUM (Carbonate)**.

POTAS'SIUM. This metal in combination is found widely distributed in nature. It is a constituent of many minerals, as silicate, in felspar; as sulphate, in alunestone as nitrate in some soils; as chloride, &c., in Stassfurt mineral, and also in sea-water, and many mineral waters. It is a common constituent of the flesh of animals, and nearly all plants contain it, usually in combination with organic acids, as tartaric, oxalic, citric, &c. When the plants are burned, these organic salts are converted into potassium carbonate, which remains in the ashes; the ashes, lixiviated in water and the solution boiled down, furnish the commercial pearl-ashes and potashes, at one time largely imported from America, and forming the most important source of this substance. Marine plants also contain considerable quantities of potash, and are incinerated for the production of kelp, of which potassium sulphate and chloride are important constituents. Suint or suintate of potassium, the soapy substance obtained by washing the wool of sheep, is also used as a source, and yields potash in great purity. Felspar has been worked for potash, but the extraction is too expensive. By far the largest source now is the salt deposit in the Stassfurt mines in Germany, which has assumed great importance. Potassium was first obtained by Sir H. Davy in 1807 by electrolysis from the hydrate. It is prepared on the large scale by subjecting a mixture of pure potassium carbonate and charcoal (which is made by igniting cream of tartar in a closed crucible) to a high temperature in a small wrought-iron bottle. The potassium distils over, and is collected in a receiver formed of two wrought-iron plates, clamped close together to give a large cooling surface. The process requires great care, and the potassium must be preserved in Persian naphtha. To obtain it pure the metal must be redistilled two or three times. It then presents the appearance of a bluish-white metal, with considerable lustre. The specific gravity is 0.865. With the exception of lithium, it is the lightest metal known, and floats on water. At 32° Fahr. it is brittle and crystalline; at 50° it is soft and malleable; at 150° it is quite fluid; and at a red heat it sublimes, forming a green vapour. The freshly cut surface is very brilliant, but it tarnishes immediately in the air, and can only be preserved in mineral naphtha. It has a great affinity for oxygen, and when heated in the air it takes fire, burning with a violet light. It decomposes water, even in the form of ice, setting the hydrogen free, and the action is so violent that the hydrogen takes fire, burning with a red flame; a globule of potash is formed, which becomes red hot, and explodes when sufficiently cool to come in contact with the water.

It unites directly with phosphorus, sulphur, chlorine, bromine, and iodine, in each case with ignition. It is a good conductor of heat and electricity. The symbol is K, and the atomic weight 39.1. It is a monatomic metal, and forms alloys with most of the metals. That with sodium is interesting as it is fluid at ordinary temperatures, and takes fire in contact with water. It combines with nitrogen. The compounds are known as monopotassamide (KH₂N) and tripotassamide (K₃N). The former is an olive-green compound, melting at 100° C. (212° Fahr.), and is

a non-conductor of electricity. It is easily decomposed, when heated, into ammonia and tripotassamide, a greenish-black infusible substance, which takes fire on exposure to air.

There are three oxides of potassium—protoxide, K_2O ; dioxide, K_2O_2 ; and tetroxide, K_2O_4 . The protoxide is white and deliquescent; it melts at a red heat, and has a great affinity for water, becoming red hot when moistened, and forming the hydrate. The dioxide is a white powder. The tetroxide is a yellow powder, which is decomposed by water, giving off oxygen and forming the dioxide.

Potassium hydrate or Caustic potash (KHO) is produced when potassium decomposes water; it is usually prepared in solution by decomposing the carbonate with slaked lime: the solution, evaporated to dryness, furnishes the hydrate. It is a white brittle substance, melting at a red heat and subliming in white vapour at a higher temperature; the specific gravity is 2.1. It is very deliquescent, and soluble in half its weight in water. It is a powerful caustery, destroying animal and vegetable tissue. The solution is official in the British Pharmacopœia; it contains 5 per cent. Caustic potash is much used in the laboratory in analysis, in fusions with minerals, and for decomposing silicates. It dissolves glass when fused with it, forming potassium silicate or soluble glass, a considerable article of commerce. It is also largely used in the manufacture of soft soaps; these are all composed of fatty acids combined with caustic potash.

Potassium chloride (KCl) is found native as sylvine on Vesuvius, and almost pure in one of the layers of the salt beds at Stassfurt. These interesting deposits have a lower bed of rock salt ($NaCl$), then a deposit of carnallite or double chloride of potassium and magnesium ($KCl \cdot MgCl_2 \cdot 6H_2O$), about 60 feet thick, with some layers of kieserite or magnesium sulphate ($MgSO_4 \cdot H_2O$), and from the carnallite this salt is manufactured and largely imported into this country; it is also obtained from kelp. It crystallizes in cubes, and is soluble in about three parts of water. It is the salt from which all the commercial salts, as the sulphate, carbonate, and nitrate, are now made; and the discovery of the Stassfurt mines has given a large impetus to this industry.

Potassium chlorate, Chlorate of potash ($KClO_3$), is an important article of manufacture, being largely used in the composition for lucifer matches, also in fireworks, explosives, and as a source of oxygen. It is made on the large scale by passing chlorine into a mixture of potassium chloride and milk of lime; calcium chloride and potassium chlorate are formed, the latter is crystallized out. About 4000 tons are annually produced in this country. It is only slightly soluble in water. The crystals are colourless six-sided plates, but they often display beautiful colours by reflection. It melts at a red heat, giving off oxygen, of which it is the common source. It is usual to add a little manganese peroxide, which facilitates the evolution of the gas; the crystals detonate violently with sulphur or phosphorus, and the presence of these and some other substances is very dangerous, and sometimes leads to dreadful explosions. It is a powerful oxidizing agent. Mixtures of potassium chlorate and tar or paraffin oil have been recently employed for explosive agents of great force, but the use of these compounds is not allowed in this country. It is used in medicine as a powerful alternative.

Potassium bromide (KBr) crystallizes in cubes. It is made by acting on bromide of iron with potassium carbonate. It is much used in medicine as an anodyne, and also in photography.

Potassium bromate ($KBrO_3$) crystallizes in six-sided plates. When heated it melts and gives off oxygen, and is generally a powerful oxidizing agent.

Potassium iodide (KI). This is a very soluble salt, crystallizing in cubes; it dissolves in half its weight of water; the solution produces a considerable fall of tem-

perature, $24^\circ C.$ (43° Fahr.) The saturated solution boils at $120^\circ C.$ (248° Fahr.) It is soluble in alcohol. It is made in the same way as bromide, and is much used in medicine as a powerful alternative. The solution is employed also as a vehicle for iodine, which is soluble in it. It is also much used in photography.

Potassium iodate (KIO_3) forms small cubic white crystals, soluble in water. These melt and give off oxygen when heated. It is also a powerful oxidizing agent.

Potassium sulphate (K_2SO_4) occurs native as arcanite on Vesuvius. It is obtained from the chloride by treating it with oil of vitriol; it is also one of the salts obtained from kelp. It crystallizes in four-sided prisms, and is not very soluble in water. The acid sulphate, commonly called bisulphate ($KHSO_4$), is a large product in the manufacture of nitric acid from saltpetre; it occurs native at Naples as misenite. It crystallizes in rhombic octahedrons. A double salt, known as plate sulphate, is obtained from kelp; it is sodio-potassic sulphate, $K_2Na(SO_4)_2$. It crystallizes in hexagonal plates, and the crystallization is accompanied by vivid flashes of light.

There are five sulphides of potassium—the protosulphide (K_2S), the disulphide (K_2S_2), the trisulphide (K_2S_3), the tetrasulphide (K_2S_4), and the pentasulphide (K_2S_5); all are yellowish-brown solids, having an odour of sulphuretted hydrogen. Liver of sulphur, or hepar sulphuris, contains the two latter sulphides.

Potassium carbonate, or Pearlash, or Potash (K_2CO_3) is made directly by carbonizing suint, or by the Le Blanc method [see SODIUM CARBONATE], from the sulphate. It may be made quite pure by calcining potassium tartrate. [See TARTARIC ACID.] It is very soluble in water, dissolving in half its weight; it deliquesces rapidly in the air. Potassium diacid carbonate ($KHCO_3$) is known in commerce as bicarbonate. It crystallizes in rhomboidal prisms. It is much used in medicine in effervescing mixtures, and in cases of gout and gravel.

Potassium cyanide and ferrocyanide are large articles of commerce already referred to. See CYANIDES.

Potassium chromate and bichromate are also important manufactures. See CHROMIUM.

For *Potassium nitrate*, see NITRIC ACID. For *Potassium oxalate*, see OXALIC ACID.

Potassium salts are detected by the violet colour imparted to the blowpipe flame; it is obscured by the yellow flame of soda salts, but this can be cut off by a coloured blue glass. It is estimated and weighed as the platino-chloride of potassium, the insolubility in alcohol distinguishing it from the soda salt. The potash industry has attained a position of great commercial importance. The Stassfurt mines alone raise 900,000 tons of carnallite annually; this is equal to 225,000 tons of potassium chloride, all of which is consumed in various manufactures and in manures. The importance of potash as a manure will be at once seen by the following table, showing the amount of potash in the ashes of various plants employed as food, and also the amount removed by each crop per acre as far as known:—

		Amount removed per acre.	
		Per cent.	Lbs.
Root crops,	Potatoes, 55	...	—
"	Turnip, 43	...	89
"	Mangold, 24	...	121
Leguminous and grass,	Beans, 51	...	52
"	Pease, 41	...	—
"	Clover, 36	...	75
"	Grass, 32	...	—
Corn crops,	Wheat, 29	...	29
"	Oats, 20	...	31
"	Barley, 28	...	80
"	Rye, 24	...	—

The amount of potash in the ashes of the following important products of daily consumption is also instructive and interesting:—

Per cent.	Per cent.
Coffee, 54	Jerusalem Artichoke, 59
Tea, 41	Cabbage, 41
Cocoa,	Carrot, 41
Rhubarb, 59	Lettuce, 46
Asparagus, 40	Onion, 35

All fruits contain a large quantity of potash; for instance, the ash of the ripe plum contains 59 per cent. Tobacco and flax are also very rich in potash. It may be added that the ash of beef contains 40 per cent. of potash, the ash of milk contains 32 per cent., and every fleece of wool removes 5 per cent. of its weight of potash.

Medicinal Properties of Potassium.—The preparations of potash which are used in medicine are very numerous, the more important being the following:—*Acetate of potash*, prepared by adding carbonate of potassium to acetic acid, is administered in doses of from 10 to 20 grains as an antacid and antilithic, from 20 to 60 grains as a diuretic, and from 2 to 3 drs. as an aperient, in each case dissolved in some bland liquid, or in the infusion of some mild vegetable bitter. *Bicarbonate of potash*, the most agreeable of all the salts of potassium, is much used as an antacid and for making effervescent saline draughts. It is useful in the treatment of dyspepsia, gout, and scurvy, and also of acute inflammatory rheumatism. *Carbonate of potash* or *salts of tartar* has been used in medicine from the earliest times, and was originally prepared from the ashes of vine twigs. It is exhibited in the form of a white crystalline powder, of a caustic taste, and readily soluble in water, the solution effervescing freely on the addition of any acid. It is used in small doses as an antacid, and it enters into the composition of the liquor arsenicalis and *mistura ferri composita*. *Caustic potash*, sometimes called *hydrate of potassium*, is prepared in the form of small sticks or pencils, which should be quite white, but which in practice have usually a grayish tinge. They speedily melt when exposed to the atmosphere, and in consequence require to be kept in closely-stoppered bottles. Caustic potash is powerfully corrosive in its action, readily destroying the skin and many other kinds of animal tissue, and hence it is employed in surgery as an escharotic. *Chlorate of potash*, which occurs in the form of flat transparent crystals, finds its chief application in the treatment of diseases of the mouth and throat. It is often of great value in cases of ulceration of the gums or sides of the mouth and tongue, and for the treatment of this form of disease it is made up in the form of lozenges, each of which contains 5 grains. It is also useful in the early stages of a cold, and taken early and frequently it will sometimes afford speedy relief from the more troublesome symptoms. For internal administration the dose is from 10 to 20 grains. A useful gargle for some forms of sore throat may also be made by adding 1 drachm of the chlorate of potash and $\frac{1}{2}$ ounce of honey to 8 ounces of water. *Citrate of potash* is prepared as a white crystalline powder, which tends to deliquesce, and is slightly acid to the taste. It agrees better with the stomach than most other preparations of the alkali, and as a cooling drink it is useful in cases of fever. It is eliminated in the urine, which it renders neutral or alkaline, and it is used chiefly in the form of an effervescent drink in the different maladies where it is desirable to produce this result. The *liquor potassæ*, or solution of potash, is prepared from the carbonate of potash by adding quicklime to its solution, and in a dilute form it is used as an antacid, diuretic, and antilithic. It is also used as a wash in certain forms of skin disease, and as a stimulating lotion generally. When taken internally it must be used with care, as an overdose would quickly give

rise to symptoms of poisoning. *Nitrate of potash* or *nitre*, which has been used in India and China from a very remote period, is given in doses of from 5 to 20 grains, as a refrigerant and diuretic. It enjoyed at one time a high reputation for the treatment of rheumatic fever, for which it was administered in large doses, but its efficacy in this respect is very doubtful. Nitre balls are often used in cases of sore throat, and cases of rheumatism and lumbago, accompanied by scanty, high coloured urine, may often be speedily relieved by the administration of nitre. Equal quantities of nitre and chlorate of potash dissolved in hot water form a solution which, absorbed by sheets of blotting paper, is very useful in relieving asthma. The sheets of paper should be doubled across the middle, and placed tent-wise on a shovel or tray, and then ignited at each extremity of the fold, when they will give off a volume of smoke, which, mingling with the air, is inhaled by the patient. *Sulphate of potash*, a waste product in the manufacture of nitric acid, is sometimes used as an alternative and aperient, and it forms an ingredient in the compound colocynth pill, and in compound ipecacuanha powder. *Sulphuretted potash*, or *liver of sulphur* (*hepar sulphuris*), made by heating sulphur and carbonate of potash together, yields a lotion and an ointment for the treatment of skin diseases, and it is also used for the formation of sulphur baths, which have been recommended for the same purpose. *Bitartrate of potash*, better known as *cream of tartar*, is a natural salt deposited during the fermentation of grape juice as a crust on the sides of the vats or casks. It is used as an aperient, a diuretic, an antiscorbutic, and in large doses in conjunction with jalap, senna, or sulphur, as a hydragogue cathartic. Half an ounce added to a pint of water, with some sugar and a few pieces of lemon peel, makes a cooling drink which is very useful in febrile and dropsical affections.

In addition to the foregoing there are several other preparations of potash of which the medicinal properties depend chiefly upon the substances with which it is combined. First in importance among these comes the *bromide of potassium*, a salt which is formed when bromine is dissolved in caustic potash ley. The salt crystallizes in colourless transparent cubes, easily soluble in water. It is a nervine sedative, and though medical opinion has fluctuated considerably as to its value, no doubt can now be reasonably entertained as to its usefulness. No drug exercises so much power as this over epilepsy, and while in common with the rest it often fails to effect a cure, it generally greatly reduces the frequency and severity of the fits. It is also administered in cases of insomnia, delirium tremens, convulsions, whooping cough, and the nightmare produced by an overwrought brain. The *iodide of potassium* is a combination of iodine with potash, and it is presented in the form of a white crystalline salt, not unlike ordinary sea salt, destitute of odour, and readily soluble in water. It is used in the treatment of many old standing diseases, such as bronchocoele, scrofula, chronic rheumatism, dropsy, syphilis, and certain chronic glandular enlargements. It is the active ingredient in one or two well-advertised patent medicines, and in combination with a little burnt sugar and water it has made the reputation of more than one "world-renowned blood purifier." It is also a medicine of great value for the treatment of chronic lead poisoning, as it possesses a remarkable power of expelling lead from the system. *Permanganate of potash*, made by heating chlorate of potash with peroxide of manganese and caustic potash, and afterwards boiling the product, occurs in dark-looking needle-shaped crystals, readily soluble in water, which takes from them a magnificent purple hue. It is sometimes prescribed in doses of from 1 to 2 grains in diabetes and to correct offensive evacuations, but it is most generally employed as an external application. Its official pre-

paration is a solution called liquor potassæ permanganatis, which, suitably diluted, is used as a lotion to foul ulcers, gangrenous sores, &c. Very much diluted it is used as a gargle or as an injection. Permanganate of potash is much used as a disinfectant, a favourite form being the solution introduced by Condy, and commonly known as Condy's fluid. When used as a disinfectant it should be added to the offensive matter until the characteristic purple colour is apparent.

POTATO (*Solanum tuberosum*), one of the most important of our cultivated plants, belongs to the order SOLANACEÆ, to which the tomato and tobacco plant also belong. It is a perennial herb, with pinnate leaves and white or purple wheel-shaped flowers; the fruit is a round many-seeded berry. The edible portion of the plant, the *tuber*, is not a root, as is sometimes supposed, but a dilated underground stem or branch, its true nature being revealed by the presence of the "eyes" or leaf-buds, which are produced in the axils of rudimentary scale-like leaves, and develop into shoots. These tubers contain a great quantity of starch, and are, in fact, "reservoirs" of nutritious matter, which is drawn upon by the young shoots when growing. In this way a method of multiplication, in addition to the ordinary production of seeds, is secured.

The introduction of the potato into Europe, and especially into England, is still a subject of controversy. It is a native of South Mexico, and was cultivated in Peru under the name "papas" before the discovery of America by Europeans. It was introduced into Europe by the Spaniards, but at what time is uncertain. In the travels of Pedro Cieza de Leon, published 1553, the papas is said to be an edible root cultivated in Peru, and eaten boiled or else dried in the sun and preserved, when it was called *chufio*. Shortly after this it was grown in several botanical gardens on the Continent, for Bauhin (1596) describes it under the name *Solanum tuberosum* in his "Catalogue of Plants," and Clusius, a botanist of Vienna, a little later gives a description and figure of the same plant.

The common tradition that the potato was introduced into England by Sir Walter Raleigh is inaccurate. In the well-known passage from the "Herbal," published in 1597, Gerard speaks of having received potatoes from Virginia. The potato is not, however, a native of Virginia, but was probably introduced into cultivation there through the intercourse of the early settlers with the Spanish. Expeditions were sent out at Raleigh's cost to found a colony in Virginia between 1585 and 1589, but he did not accompany any of them in person. In 1586 an expedition which had gone out the previous year was brought back to England by Sir Francis Drake, and it seems probable that the colonists brought back with them the first potatoes that were introduced into England. In this way it is possible to account for another tradition that it is to Drake that we owe the potato. One of these colonists, Thomas Hariot, in his report on the commodities of Virginia, makes what is thought to be a reference to this vegetable under the name of "openauk." "Openauk," he says, "are a kinde of root of round forme, some of the bigness of walnuts, some farre bigger, which are found in moist and marshy grounds growing many together one by another in ropes as though fastened with a string. Being boiled or sodden they are very good meat."

The word *potato* itself is but an Anglicized form of *batata*, which seems to have been early used by the Spaniards for the tubers of the Sweet Potato (*Batatas edulis*). In Gerard's "Herbal" the newly-introduced "papas" is stated not to differ much "in shape, colour, or taste from the common potatoes."

Though thus introduced as an edible root in Queen Elizabeth's reign, it was long before the cultivation of the potato became general, though it was strongly urged by the Royal Society in 1668 with a view of preventing famine

through failure of the grain crops. It was only in 1725 that it was introduced into Scotland; and it was some fifty or sixty years later before it became a general field-crop in that country and in England. Ireland, at a much earlier period, took the lead of all European countries in its cultivation.

Though the plant may be propagated both by its seed and tubers, practical management has confined the cultivation to the latter mode, except for the purpose of raising new varieties. In order to obtain seed, properly so called, the potato-apple when perfectly ripe should be dried, and then disengaged from its seed by rubbing with the hand. The seed should be preserved in a dry place, in paper or cloth bags, until the middle of March or beginning of April, when it may be sown in wooden boxes or earthen pans with a covering of less than half an inch of well pulverized earth. The vessels ought then to be placed in hotbeds of mild heat, such as is suited to the raising of half-hardy annuals. The plants, when an inch high, should be pricked out into other vessels, and placed in a temperature somewhat lower than before, to inure them to the external air, to which they should be exposed after frosts have ceased. These plants should be put out in drills 16 inches apart, and with an interval of 6 inches between the plants in the rows. They will produce tubers in the first year, and these may be planted in the following season in the ordinary way.

To market-gardeners it is a great object to raise the earliest potatoes, considering the high price which they obtain for them, though in their waxy state they are neither wholesome nor palatable.

The best soil for potatoes is a rather light friable loam. The land should be prepared and manured in the winter in readiness for the planting as early in spring as the weather admits. Abundance of manure, however, tends to increase the liability of the crops to disease; it is often applied in the drills at the time of planting. For early crops the time for setting should be about the end of February, and the planting of the main crops should not be delayed later than the middle of March. It is usual to plant cuttings of the tuber, each containing one or two eyes, though small tubers are generally planted whole.

The most approved mode of setting potatoes is in drills. The sets are laid down at the average distance of 16 inches by the setters, who move in a retrograde direction, provided with baskets or aprons to contain the sets. A sufficient number of men is in attendance to divide the manure evenly in the drills; the plough also is in the field in order that there may be the least possible exposure of the manure and sets to the sun or to parching wind, but the plough should cover the sets rather lightly in clay soil. The roller is next used to lay an even surface to the shooting plants, and to facilitate the subsequent progress of the paring plough, which is to be set to work when the stems are 6 or 7 inches high, and should move as close to the plants as is practicable without injuring their tender fibres. As to the distance between the drills, due regard must be had to the nature of the soil and the quantity and description of manure available; for a general average 30 inches is best. Sets placed 6 inches under the surface yield the best crop.

In all cases in earthing potatoes the earth should be rendered as loose and friable as possible by spade, hoe, or plough, and where labour is easily commanded, the spade will be found to be the most efficacious implement in the first course of treatment after the plants are well up.

In minute husbandry, such as that exemplified in labourers' allotments, which excludes the plough altogether, the ordinary and best practice is to lay the sets in rows, after a very deep winter digging, marked with a garden line. The workman digs precisely as in a garden plot for cabbages; he clears a little drill, lays the sets straight, puts a sufficiency of manure over them, and then covers from the next spit, which he digs with a spade or

three-pronged fork flattened at the ends, levelling and pulverizing as he advances to the distance at which he again puts down his line and forms a new drill. Thus the entire piece is thoroughly loosened, the manure perfectly covered, and every facility given for the hand-hoeing in due course.

When the potatoes are ripe, which is indicated by the withering of the stalks, the crop may be taken up either by the plough (after the stalks with any tubers that may be attached to them are pulled up), or by prongs or long narrow spades without the plough. In wet weather this more tedious but far safer method is frequently adopted, and if the drills be short and the head-riggs under crop also, it is the most desirable, effectual, and economical mode.

The general mode of securing the crop in pits in the field is the safest. In making the pits—inproperly so termed, for the base is only sunk a few inches, and the potatoes are raised considerably in the heaps—the only caution to be observed is that the furrows should be cut on all sides to prevent water from lodging or penetrating inwards, and that the earth thrown up and over them to the depth of 4 or 5 inches should be well beaten with spade or shovel to exclude light and frost. When the potatoes are exposed to light they become green, bitter, and unwholesome. The potato stalks, however apparently dry, should never be laid between the potatoes and the earth in these accumulations, for they soon ferment and rot, and injure all the potatoes in contact with them. Eight tons per acre is regarded as a good crop.

In cultivation a great number of varieties have been established, some early and some late, and some more suited to particular localities than others. Differences exist in the character of the herbage, the form of the leaves, and the size and colour of the flowers. The tubers also vary greatly in size, form, and colour, being round or kidney-shaped, with the rind yellowish-brown or purple, and the flesh white or reddish, &c. Other species of *Solanum* are also to some extent cultivated, and varieties established by hybridization and grafting. The diseases to which the potato is subject are noticed in the article **POTATO DISEASE**.

It is the large quantity of starch present in the potato tuber that makes it such a valuable article of food. Compared, however, with wheat and other cereals it is deficient in albuminoids, and so requires to be eaten with milk, pulse, lean meat, &c., to thoroughly sustain life. The composition of the potato as given by Professor A. H. Church is as follows:—

Water,	75.0 parts.
Fibrin and albumen,	2.3 "
Starch,	15.4 "
Dextrin and pectose,	2.0 "
Fat,	0.8 "
Cellulose,	1.0 "
Mineral matter,	1.0 "

As a vegetable the potato may be prepared for the table in many different ways, but it should always be boiled or steamed first to destroy a poisonous principle contained in the rind. The starch of the tuber is a very important product, and that of diseased potatoes may be utilized with perfect safety. It is sometimes used to adulterate wheaten flour in the manufacture of bread. The starch by roasting becomes dextrin, which is used as a substitute for gum, size, or paste. A spirit called potato brandy is also made from the starch, which by the action of weak sulphuric acid is changed into glucose, and this, by fermentation, yields alcohol. The stem and leaves have slightly narcotic properties.

For confectionery the flour is so delicately white, and it is so digestible and nutritious, that it ought to be in more general use, among the children of the poor especially, in

the winter season, when they so rarely enjoy the luxury of milk; and the cost is not more than a sixth or seventh of the price of tapioca or arrow-root, if it be made at home. Few housewives are ignorant of the method of obtaining it by the use of a common hand-grater and sieve; but for yielding larger supplies some machinery is necessary. Potatoes should not be relied on as a staple article of food. The failure of the potato crop in Ireland in 1845-49 caused a terrible famine, which was but partially alleviated by the £10,000,000 sterling voted by the British Parliament.

According to the official agricultural statistics, published in 1886, there were 1,375,000 acres planted with potatoes in the United Kingdom—viz., England, 369,000 acres; Wales, 40,000 acres; Scotland, 165,000 acres; and Ireland, 810,000 acres. In addition to the home produce, 2,300,824 cwt. of potatoes were imported in 1885—chiefly from Germany, Belgium, France, Holland, and Portugal. The London market is plentifully supplied with early new potatoes from Cornwall and the Channel Islands.

POTATO, SWEET. See **BATATAS**.

POTATO BUG. See **COLORADO BEETLE**.

POTATO DISEASE. This terrible plague, the cause of many famines, is usually stated to have first appeared in this country in 1845. The disease known as *curl* is, however, only a form of the potato murrain, and was prevalent to a greater or less extent ever since the cultivation of the potato became general. But it was about this time that general attention was painfully directed to the subject by the terrible famines in Ireland, especially in the year 1846, caused by the wholesale failure of the potato crops. The exact nature of the disease was for some time in doubt. It is now known to be caused by the growth of a fungus (*Peronospora infestans*) within the tissues of the potato plant. It is prevalent in damp, warm weather, usually first appearing in England about the end of July. The first signs are brownish or blackish blotches on the tips and edges of the leaves, which as the fungus extends through the tissues, spread on to the leaf stalks and stems, and ultimately to the tubers, till the whole plant becomes putrescent. The minute fungus which causes the disease gains admission by its germinating spores pushing their way through the epidermis of the leaves, and there ramifying to form a mycelium of numerous threads, which breaks down the cellular tissue and sets up decomposition. Here and there through the stomata or pores which crowd the under surface of the leaf, these mycelial threads protrude into the air and branch irregularly, producing at the tip of each branch one or more conidia. The conidium, after coming into contact with water, as a drop of rain or dew, liberates several zoospores, which swim about by means of their cilia, and at length attach themselves to the epidermis of the host, take a spherical form, germinate, penetrate into the intercellular spaces, and so reproduce the mycelium. In addition to this asexual method of reproduction, true sexual organs are developed on branches of the mycelium within the tissues of the host. The female organ or oogonium is fertilized by the antheridium, and as a result produces an oospore, which becomes detached from its supporting thread, and remains quiescent for a period of from nine to twelve months, sometimes for as long as two years. These resting spores, which have a rough, thick, dark-brown envelope, on germination reproduce the mycelium. As a rule the tubers become diseased by the mycelium extending downwards in the interior of the stem, but any that chance to be uncovered may be attacked at once by the spores falling on them and germinating. Too much care cannot be taken in burning or burying deep the affected tubers and herbage, so as to destroy the resting spores.

POTATO-STONES are rounded pebbles of **DOLOMITE**, hollow inside, and having the cavity lined with crystals of

PEARL-SPAR. They are probably fragments of limestone that have become chemically altered by contact with waters containing magnesian salts in solution; and the internal hollow is supposed to have been produced by the diminution in bulk consequent upon the chemical change.

POTEMKIN, GREGORY ALEXANDROVICH, a Russian soldier and statesman, was born in 1739, in the village of Donnovo, in the government of Smolensk, his father being a poor nobleman of Polish origin. Being destined for the church, he studied theology at Moscow, but an opportunity of entering the army being offered him, he eagerly seized it. Handsome in form and feature, he attracted the notice of the voluptuous Catharine when she was yet but grand-duchess, and he assisted her in her conspiracy against her husband on the 10th July, 1762. After this event he became one of her leading favourites, and despite the jealousy of the Orloffs his fortunes were rapidly advanced. He was the avowed lover of the empress from 1774 to 1776, and though in the latter year he had to give place to a successor, his political influence remained undiminished, and from 1778 till his death the foreign policy of Russia remained in his hands. There was always a wild tinge of extravagance in his ideas and projects, and it was his constant aim to aggrandize Russia at the expense of the Turks. By his agency the Crimea was annexed in 1783, and he was thereupon appointed governor of the Crimea and general admiral of the Black Sea. In January, 1787, the empress visited his government, the journey, which lasted until the following July, being remarkable for the fantastic extravagance by which it was accompanied. Under the direction of Potemkin the towns of Kherson, Kertch, Nicolaiev, and Sebastopol were founded, and a fleet was built to defend the coasts against the Turks. When the war broke out with Turkey in 1787 Potemkin was placed at the head of the army, and though he appears to have possessed but little military genius, his subordinates, Souwaroff and Repnin, enabled him to gain the credit for a series of victories, of which the most important was the capture by assault of Otchakoff, 16th December, 1787. In March, 1791, he proceeded to St. Petersburg, where he was lavishly rewarded by the empress. Returning in the autumn to the south of Russia, he died from disease on the road between Jassy and Nicolaiev, on 16th October, 1791. His body was interred at Kherson, but the Emperor Paul afterwards caused it to be exhumed and thrown into a ditch. Potemkin was a man of considerable ability and vast ambition, but he was arrogant and capricious, extravagant to an extraordinary degree, and throughout his whole career grossly licentious. See "*Mémoires de la Cour de Russie*," by the Prince de Ligne (Paris and Berlin, 1859).

POTENTIAL, a term in electricity, not very easy to clearly explain, though indispensable and of great significance. Potential is the term for the power of doing electric work possessed by a certain conductor, but is strikingly distinct from electrical quantity or electro-motive force. An analogy may make its nature clear. Let there be a number of vessels, one holding a pint, another a quart, another a gallon, &c. Then it is evident that if the same quantity, say a pint, be poured into each, one will be fully charged, another half-full, another only an eighth part full, and so on. Electric conductors differ in capacity—that is, in the quantity of electricity they can hold—both according to their size and shape; and shape being the same the larger a conductor the more electricity is needed to electrify its surface to the same degree. Therefore a small quantity of electricity may fill a conductor to the full amount of its capacity, and this is described as raising it to a *large potential*. Positively electrified bodies are described as of *high potential*, negatively electrified bodies as of *low potential*, the imaginary level from which these terms vary each way, higher or

lower, being called *zero potential*. Zero potential is always taken as the potential of the earth's surface at the spot where the experiment is made. When looked at in this way zero potential resembles the sea level of altitudes; and in fact potential altogether is a sort of *electric level*.

But it is necessary to measure potential; and that is done in this way:—Suppose a small insulated stationary sphere has a charge of positive electricity upon it, it will then repel any positively electrified sphere brought near it; and the nearer the movable sphere came the greater would be the repulsive force. Potential at any point is the amount of work that must be spent upon each unit of positive electricity in bringing it up to that point from an infinite distance (potential is *nil* at an infinite distance). A small calculation by the integral calculus will prove that the apparent result is really true, namely, that potential is the quantity (*i.e.* the number of units) divided by the distance; or in a formula (V always standing for potential, r for distance, and q for quantity):—

$$V = \frac{q}{r}.$$

To find the potential at any point, therefore, divide the quantity of the charge by the distance of the charged conductor from that point.

It follows that at the same distance from the charged conductor the potential will be the same; that is, that a charged spherical conductor will be surrounded by shells of space, or air, of equipotential value; or as they are termed, *equipotential surfaces*. These surfaces rise in potential as they approach the charge, and their rise is measured by units potential. Unit difference of potential is that which it requires one *Erg* of work to surmount.

Magnetic potential, in like manner, is measured by the work necessary to bring up a unit magnetic pole (north-seeking pole) from an infinite distance against the repulsion of a given north-seeking pole, and like terms and units hold good with relation to it.

Potential due to current-electricity moving in a closed circuit is closely akin to that of electrostatics. The potential (V) due to a current passing along a closed voltaic circuit may be ascertained for any given point, P , by multiplying the strength of the current in electromagnetic units (i) by the solid angle (S) subtended by the circuit at that point.

$$V \text{ (at } P) = -Si.$$

(Potential being thus measured against the current, the sign is *minus*.) To ascertain the difference of the potential due to a closed circuit at the point Q from that at the point P , the formula is—

$$V \text{ (at } Q) - V \text{ (at } P) = i(S \text{ at } Q - S \text{ at } P).$$

Circuits attract and repel each other according to the direction of their currents; there is therefore the phenomenon of *mutual potential* to account for. This is measured by the following formula: let i be one circuit, i' the other, and let the areas be s and s' respectively; then if the distance between their centres be r , and S the angle between them, it appears after the due calculation (which must be omitted here) that

$$MV \text{ (mutual potential)} = ii' \left(\frac{\cos S}{r} \right) ss'.$$

Potential Energy.—Though the far greater use of the word potential in an electric and magnetic sense tends to limit it to that sense, it is really but a branch of potential energy in general. Just as electricity at high potential tends to flow towards the point of lower potential (or from positive to negative), this being the cause of electric currents, so also water tends to find its own level, compressed

stem to expand into equality of pressure with the air, a spring to uncoil itself, and a suspended weight to fall. These are all forms of potential energy; that is to say, they only need opportunity to do absolute work, and when this occurs the potential becomes kinetic energy. The origin of the term and idea of potential, at first a little puzzling to beginners in electricity, thus becomes clear.

POTENTILLA is a genus of plants belonging to the order ROSACEÆ, closely allied to the strawberry plant (*Fragaria*), from which it differs chiefly in having the seeds in a dry instead of a succulent receptacle. Several of the species are British. *Potentilla fragariastrum* (the barren strawberry), with ternate leaves and small white flowers, grows in woods and on hedge banks, and is sometimes mistaken for the wild strawberry. *Potentilla reptans* (creeping cinquefoil), found on roadsides and banks, is distinguished by its slender creeping runners, quinate leaves, and large yellow flowers. It was formerly used medicinally, and is still employed as a febrifuge by some practitioners. *Potentilla tormentilla* has the stem procumbent or ascending, the upper leaves ternate, sessile or shortly stalked, the lower quinate on long stalks and small yellow flowers. The roots are very astringent, and have been used medicinally. In the Western Isles of Scotland and the Orkneys they are used for tanning leather, and are preferred even to oak bark. They are also used for dyeing a red colour. *Potentilla anserina* (the silver-weed), with creeping stems, large yellow flowers, and pinnate leaves, the leaflets of which are covered with a silvery silky down on the under surface, is common on roadsides. It has roots which are eaten both by hogs and men; they taste like a parsnip, and are roasted or boiled for food. In the islands of Tiree and Coll they answer in some measure the purposes of bread, and have been known to support the inhabitants for months together during a time of scarcity. Many species are cultivated as garden plants, producing handsome flowers.

POTENZA, a town of South Italy, the capital of the province of the same name, is pleasantly situated on a spur of the Apennines. 85 miles E.S.E. of Naples. An earthquake in 1857 destroyed almost the whole town, since which time it has been rebuilt. Its chief edifices and institutions are a cathedral and an hospital. The population in 1882 was 20,281.

POTERIUM is a genus of plants belonging to the order ROSACEÆ. The name is a Latinized form of the Greek *poterion*, and alludes to the fact that the leaves were employed in the composition of the old English drink known as a cool tankard. The flowers are monœcious and collected into compact heads. The Lesser Burnet (*Poterium sanguisorba*) occurs on dry chalky soil in Britain. It is an herb, having an angular stem and pinnate leaves, with many small, ovate, coarsely serrated leaflets. It forms a useful fodder for cattle, and at one time was extensively cultivated for that purpose, but is now generally superseded by sainfoin and other artificial grasses. On the Continent, and occasionally in this country, the young leaves are eaten as salad. *Poterium muricatum*, which is larger, and distinguished by its four-winged pitted seeds, is found in England apparently wild, but has probably been introduced from the Continent; some consider it only a variety of the lesser burnet. Both species are often sown unintentionally together with sainfoin (*Onobrychis sativa*), owing to the resemblance of the seeds, and choke the more important crop.

POT-HOLES are more or less vertical hollows in limestone districts, sometimes of enormous depth. They have been produced mainly by the solvent action of the carbonic acid contained in water flowing down an original fracture or place of weakness in the rock; and when streams fall into them there is also a certain amount of mechanical degradation due to the motion of the water. "Each re-

presents the weak point towards which the rainfall has converged, caused very generally by the intersection of the joints. This has gradually been widened out, because the upper portions of the rock would be the first to seize the atoms of carbonic acid, and thus be dissolved more quickly than the lower portions. Hence the funnel shape which they generally assume, and which can be studied equally in the compact limestone or in the soft upper chalk." (Dawkins.) Numerous large examples occur in the neighbourhood of Ingleborough, in Yorkshire, and several of them are connected with the subterranean course of the Dalebeck. See Boyd Dawkins' "Cave Hunting."

POTI, a seaport of Russian Transcaucasia, in the government of Kutais, on the Black Sea, 193 miles W.N.W. from Tiflis. It has no manufactures, but exports silk and cocoons, wool, maize; and imports manufactured goods, sugar, &c. Notwithstanding attempts to improve it, the town is a poor place, but extensive works are now in progress to increase the harbour accommodation.

POT-METAL is the name given to an alloy of lead and copper made by dropping small pieces of copper into melting lead. It is of a gray colour, brittle, and granular. The term is also used to designate a kind of glass which has been coloured by the addition of the colouring matter while the glass was in a molten condition.

POTOMAC, a large river in the United States of America, which, as forming the boundary between the states of Maryland and Virginia, became the scene of several engagements in the Civil War. It is formed by two branches which rise in the Alleghany Mountains, and unite 20 miles below Cumberland, in Maryland, from whence the river flows in a south-easterly direction into Chesapeake Bay. It breaks through the Blue Ridge Mountains at Harper's Ferry, where the negro insurrection, led by John Brown, took place on the 11th of October, 1859, and which, in the War of Secession, was alternately occupied by the Federals and Confederates. Between Westport and Washington, the most picturesque part of its course, it falls 1160 feet. Its principal tributaries are the Shenandoah, Savage, and Monocacy. Its total length is 420 miles, and at its mouth it forms an estuary from 4 to 8 miles broad. It is navigable for the largest ships to Washington, which is situated upon it, about 17 miles below its falls, and for small craft 160 miles further to Cumberland. The tide ascends to Georgetown, 2 miles above Washington. The Federal forces destined for the attack upon Richmond, the Confederate capital, were called the Army of the Potomac.

POTOROO. See KANGAROO RAT.

POTOSI, a town in South America, in the republic of Bolivia, and in the department of Potosi, situated on the declivity of the Cerro de Potosi, at an elevation of 13,300 feet above the level of the sea. It is built on an uneven site, and the streets are consequently irregular, but they are tolerably wide and clean. Many of the houses are large, but the town has generally a decayed and ruinous appearance. On one side of the principal square stands the government house, a long low range of buildings, including the courts of justice, the gaol, and the guard-house. Opposite to it is the cathedral, an immense edifice, which has very little claim to architectural beauty. The mint also is very large, but far from being a handsome building. This great square contains a monument erected in honour of Bolivar. The mountain, or Cerro de Potosi, is 16,000 feet high. It contained the richest silver mines in the world, discovered accidentally by an Indian, and worked by the Spaniards since 1545, the openings into it numbering altogether, it is stated, about 5000. The value of the silver obtained from it since 1556 is said to be upwards of £300,000,000 sterling. Great difficulties now attend its working. The town of Potosi contains about 22,000 inhabitants; early in the seventeenth century

its population is believed to have been nearly 160,000. The vicinity is barren and cheerless, and all articles of merchandise are expensive.

POT-POURRI, a French term for a mixture of odorous flowers, roots, gums, &c., varied according to the taste of the operator, either mixed together dry, or in the fresh state preserved with salt. "The usual way of making it is to collect roses, lavender, violets, jessamine, woodruff, and other sweet-scented flowers; to put them into a jar stratified with salt until a sufficient quantity has been collected; then to add to these such other odorous substances as may be required to form an agreeable perfume." Among the substances thus added are ambergris, benzoin, calamus root, cascarilla, cassia, cassia buds, cinnamon, civet, cloves, musk, orange berries and flowers, orris root, pimento, storax, vanilla, yellow sandal wood, &c. When dried flowers are used they are generally mixed with crushed spices, and placed in a vase having a perforated lid, through which the perfume may be diffused throughout the room in which it is placed. The name is also applied in music to a medley of separate airs, and in cookery to dishes prepared of numerous kinds of viands. In the latter signification pot-pourri is synonymous with the Scotch *hotch-potch* and the Spanish *olla-podrida*.

POTSCHERFSTROOM, a town of the Transvaal state, South Africa, capital of a district of the same name, well placed on the Mooi River, 100 miles south-west of Pretoria, 4000 feet above the sea-level. The district of Potscherfstrom, one of the best known and most settled of the country, slopes from the Witte Waters Rand on the north to the Vaal on the south, and is generally from 3500 to 5000 feet above the sea. Its pasture lands are very extensive; the climate is healthy, and tobacco, indigo, vines, and fruits may be grown in the valley of the Mooi. The town has three Dutch and two English churches, a government school, and two papers. It possesses a good trade, has an excellent daily market, which affords the best facilities for the disposal of the several products of the country, both at the Diamond and Gold Fields, from which it is about equidistant.

POTS'DAM, the chief town of the government of Potsdam, in Brandenburg, Germany, is situated on the Havel, at the point where that river is joined by the Nutho, and 16 miles by railway south-west from Berlin. Though somewhat monotonous it is, next to Berlin, the handsomest and best built town in Prussia, a distinction for which it is indebted to its being the occasional residence of the court. The streets are regular and broad, and there are some elegant squares, in one of which is a marble obelisk 76 feet high. The town is surrounded by a rampart, and has nine gates (five of these entrances being by land and four by water). The Brandenburg gate is a handsome triumphal arch, copied from Trajan's arch at Rome. Among the public buildings the following are the most worthy of notice—the royal castle and council-house; the town-hall, built after the model of that of Amsterdam; the theatre; the poor-house and infirmary; the military orphan asylum, and several other charitable institutions; the garrison church, with a spire 400 feet high and a beautiful pulpit, and which contains the tombs of Frederick William I. and Frederick the Great; the Church of the Holy Ghost, with a fine steeple 280 feet high; and the barracks. The whole town has been called "a huge barrack," from the number of soldiers always in it. The principal manufactures are silk, cotton, linen, woollens, leather, hats, hosiery, refined sugar, musical instruments, fire-arms, and carriages. In the vicinity of Potsdam are numerous agreeable promenades, and the palace of Sans-souci ("without care")—the favourite residence of Frederick the Great, embellished by Frederick II., and occupied by Napoleon in October, 1806, which is surrounded by a fine park, pleasure grounds, and choicely-stocked gardens; the new palace, the residence

of the Prince Imperial; the marble palace; and the *Hausen Insel*, an island in the Havel, with a summer house, menagerie, palm-house, and flower gardens. Potsdam was the birthplace of Alexander von Humboldt. It was made an arsenal in 1721. The population in 1881 was 48,447. In the vicinity is a small settlement of Russians.

POTSTONE, STEATITE, or SOAPSTONE, a soft magnesian rock, of greenish-gray colour, found associated with serpentine, chlorite, and talc. In some districts, especially in the north of Italy, it is largely manufactured into cooking-pots and vases, and it was similarly employed by the Romans, who gave it the name of *lapis ollaris*. The same material is also occasionally used in furnaces as a substitute for fireclay.

POTSTONES are large pear-shaped masses of flint occurring in vertical rows in chalk, and so called especially in Norfolk. They are described by Sir Charles Lyell as "usually about 3 feet in height and 1 foot in their transverse diameter, placed in vertical rows, like pillars, at irregular distances from each other, but usually from 20 to 30 feet apart, though sometimes nearer together." These flints are closely similar in size and shape to the large sponges called Neptune's Cups (*Spongia patera*), which grow in the seas of Sumatra, and they are probably fossil forms of the same subkingdom.

POTTER, CIPRIANI, a distinguished English musician, was born in London in 1792, and died in 1871. He was the pupil of Attwood, Calcott, and Crotch, and became one of the best pianists of his day as well as a composer of great merit. He was one of the original founders, and frequently a conductor of the Philharmonic Society, and also one of the founders of the Royal Academy of Music, where he taught so successfully that on his retirement the Potter exhibition was founded to commemorate his services.

POTTER, PAUL, was born at Enkhuysen, in Holland, in 1625. He was taught the rudiments of painting by his father, an artist of moderate ability. He established himself at the Hague, where he was greatly patronized by Maurice, prince of Orange, for whom he painted some of his finest pictures. He was naturally of a delicate constitution, which by his unremitting attention to his art he greatly impaired, and died at Amsterdam, 15th January, 1654. His chief excellence consisted in his painting of cows, sheep, goats, and other animals. He makes his landscape a subordinate part, but the animals are executed with a correctness of drawing and a delicacy of touch perfectly astonishing. He succeeded best in cabinet-sized works. There are many beautiful etchings by him, executed in a masterly style. His chef-d'œuvre is the well-known "Young Bull," containing a group of cattle and their shepherd, all life size (1647), now in the Museum at the Hague. The National Gallery has one landscape only; the Duke of Westminster has the finest Potter in England. But the most beautiful works of this artist are neither here nor in Holland, but at St. Petersburg (the Hermitage).

POTTERIES, THE, the name given to a district of England, in the north-west of Stafford, abounding in coal and clay, comprising the great pottery establishments for which the county has long been famous. It is very populous, having within its towns and villages, on an area of about 20 square miles, a population of about 500,000.

POTTERY. The term pottery, common in various forms to the vast number of Aryan languages, is generally applied to all objects which are manufactured from baked clay. Its invention dates from the remotest antiquity, the most barbarous races having at all times made use of vessels of earthenware. The Egyptians, in the earliest ages of their history, made bricks of clay, which they mixed with straw and dried in the sun; and these bricks were applicable to almost every purpose of construction in a country where so little rain falls. They were impressed with their

maker's name or trade mark, and, at a later period, with the *cartouche*, or name and title, of the king in whose reign they were made. They also manufactured earthen vessels; some of a deep red colour, some of a pale red, approaching to yellow, and others of a glazed and shining red. The latter were used only by the wealthy, and for such purposes as holding perfumes, incense, honey, or wine. The Egyptian potters also possessed the secret of a finer glazed pottery, rather absurdly called by Egyptologists porcelain, made of a fine sand or frit fused lightly together, and enamelled with a green, white, blue, or purple glaze. The blue was especially lustrous and beautiful, and how it was produced is still unknown, except that oxide of copper

was one of the materials employed. The quaint figures of the Egyptian deities, elegant toilet vases, drinking cups, personal ornaments, and the images, urns, and other sacred articles deposited with the dead were made of this "porcelain," but the vast bulk of Egyptian ceramic remains consists of simple coarse earthenware made from the unctuous clay of the Nile. The antiquity of Egyptian pottery is enormous. Hieroglyphics referring to the potter's art commence from the remote era of the third and fourth dynasties, 3000 to 2000 B.C., and represent various kinds of fictile vessels, the earliest of a red earthenware, in use for the ordinary purposes of domestic life. A succession of these curious sepulchral pictures enables every process of the art

Fig. 3.

Fig. 2.

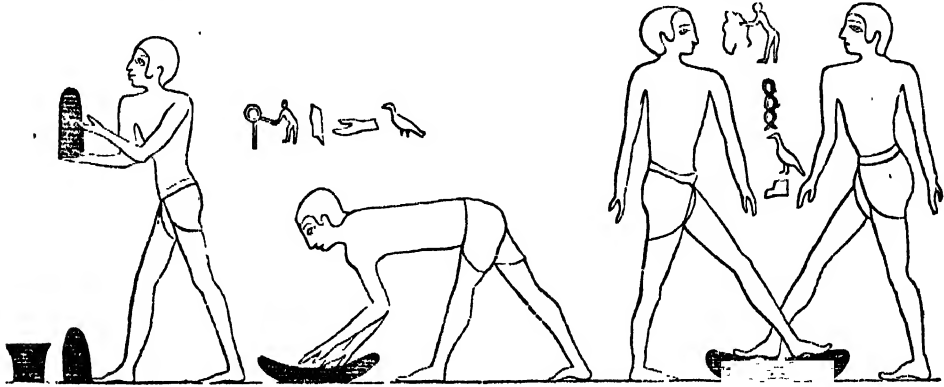


Fig. 1.

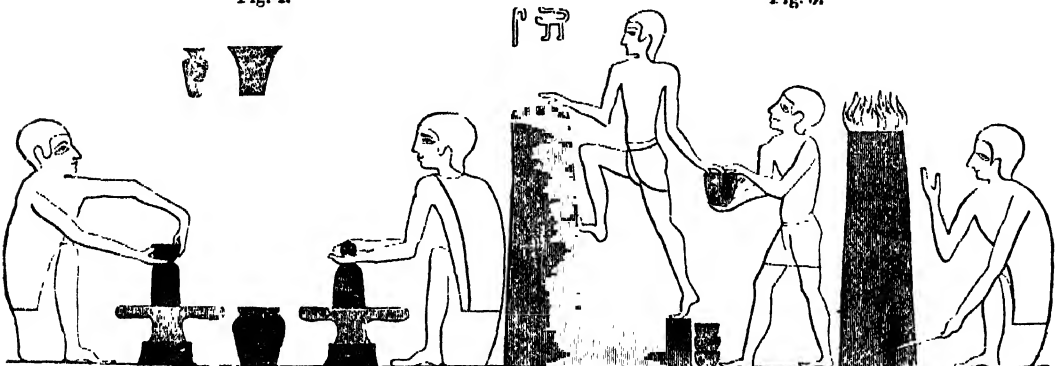
to be followed with accuracy. The wall-paintings of the tombs excavated at Beni-Hassan, while the sovereigns of the twelfth dynasty were in power, have supplied the accompanying illustrative examples. After the clay had been dug up, it was prepared by kneading with the feet—a process denominated *hi hat* (fig. 1). The clay in this state was divided into suitable masses by the workmen (fig. 2), and carried by them (fig. 3) to be wrought on the wheel or by the lathe. The wheel is represented twice in

fig. 4; it was a flat table, circular or hexagonal in form, and it appears to have been turned with the left hand, while the right was engaged in forming the required vessel. The various objects, when formed, were placed in a blast furnace, cylindrical in shape, from the head of which the flames issue forth (fig. 5).

The vases made of glazed pottery (porcelain) are of small size, few of them being more than 12 inches in height; and such vases as were produced in this manner were evidently

Fig. 4.

Fig. 5.



designed rather for decorative than for useful purposes. Sepulchral figures, called *Shabti*, were made in great abundance in Egypt, of the brightly-coloured glazed pottery. So numerous, indeed, are these singular relics, that the production of them must have constituted a staple manufacture in the potteries of ancient Egypt. Known to have been used only in Egypt, where they were universally employed by persons of all ranks in their burial ceremonies, the *Shabti*, which vary in height from about a single inch to 9 or 10 inches, may be supposed to represent, and to

have been substituted for, the human victims that at one time were sacrificed at the funerals of the great and wealthy. It appears from the formula inscribed upon the *Shabti* themselves, that the use of these figures was to aid the deceased in his labours of preparing and irrigating the ground, and raising the crop in the mystical fields of the other world.

The same material was also employed by the ancient Egyptian potters for the manufacture of innumerable small figures of the animal-gods and other objects, to be worn

as amulets by both the dead and the living, together with bugles and beads of various sizes and forms, adjusted to the requirements of the wearers, by being made in the form of pendants, studs, ear-drops, fibulae, and rings.

Pottery was a common manufacture with the Chaldeans and Assyrians. Bricks, both sun-dried and kiln-burnt, were made at Babylon as early as 2000 B.C. The great Assyrian and Babylonian buildings were raised on platforms constructed with these bricks, which, like the Egyptian, bore the cartouche of the reigning sovereign. Bricks also furnished the writing materials of the Assyrians, who had them fashioned into cubes and prisms, and then printed their records on the sides. See BABYLONIA.

Passing over the pottery of the Parthians, Jews, and Phœnicians, we come to the period of its remarkable development as an art manufacture by the Greeks. They applied to this material the term *keramos*, whence our English word ceramic, and manufactured almost every kind of article, from the vases that adorned the tables of Pericles and Alcibiades to the pans in which the Greek women fetched water from the spring, either in enamelled ware, terra cotta, or sun-dried clay (figs. 8, 9, 10). Even large

Fig. 6.



Diogenes in his tub (a *pythos* of coarse red pottery).

attracted by its imperishableness and consequent security for the long preservation of the beloved remains. Thus, the native Brazilian Indians, the Tupinambas, by means of

Fig. 7.



Funeral jar of the Indians of Brazil.

some white liquid, glazed the inside of their funeral vessels, and made them so large as to contain the entire figure with ease. The illustration (fig. 7) represents a chief of the Coroados Indians in his funeral jar, decked with his war

ornaments and his arms, sitting on his heels in the usual posture of the savage in repose, and having some animal at his feet. Such sepulchral deposits are found at the foot

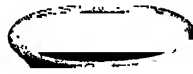
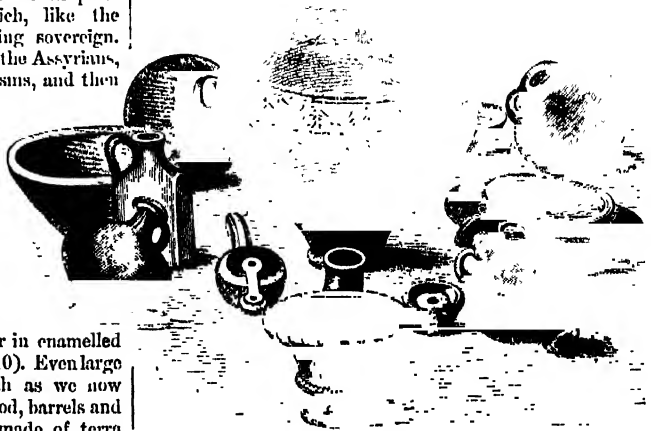


Fig. 8.



Group of ancient Greek common black pottery.

of the large trees of the forests. The elegance of their design, and the beauty of their ornamentation, have long commanded the admiration of connoisseurs; and our modern artists find themselves unable to surpass the ancient models. This subject is dealt with at some length in the article CERAMIC ART, which is fully illustrated.

The only speciality in Roman pottery, which was for the most part, like all Roman art, imitative of the Greek, was the lamp of terra cotta. Such lamps are found in large numbers and often of great beauty. Most were evidently made during the imperial age of Rome. They were manufactured from moulds, and variously ornamented with groups of figures, devices, and patterns. Had the Romans of the empire been gifted with a historical taste, their lamps would have contributed in no slight degree to the illustration both of their personal memoirs and of their national history; but the lampmakers of those times knew well the frivolous character of the purchasers for whom they worked, and therefore they were content to decorate their productions with figures of popular divinities, demigods, and heroes, and with representations of incidents, fables, and ornaments such as would be sure to be in harmony with the prevailing sentiments of the day. Among the most remarkable examples that have come down to us, are several lamps bearing the devices and monograms adopted by the early Christians, with which may be included one (fig. 11) upon which is stamped in relief the golden candlestick of Israel, as it appears upon the arch of TIRUS.

Fig. 9.



Greek painted pottery. A thesian *lekuthos* (lecythus); subject, Electra and Orestes.

British pottery begins with works produced during the Roman occupation. Several kilns have been explored, in excellent preservation, by archaeologists. The best remains were found at Castor, in Northamptonshire, and are of a

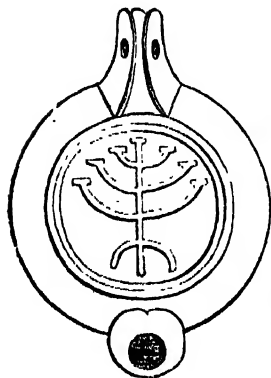
Fig. 10.



Greek painted Vase. Dionysiac subject.

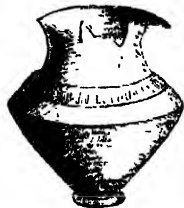
red or gray body, quite covered by a rich black glaze. It has been ascertained that in the case of this black ware (figs. 12, 13, 14, 15), the fire, or rather the smoke of the fur-

Fig. 11.



Early Christian Lamp.

Fig. 12.



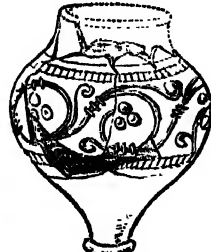
Roman-British glazed black vase, Castor, Northampton.

bits to assimilate rather to the British than to the Roman types. The paste both of the Celtic and Saxon pottery is coarse, and consists of the clay found on the spot, and without much preparation, and it has undergone a baking of only a very imperfect kind. The vessels are of a dull blackish-brown hue. They are generally of an urn shape, tapering towards the base, and having wide mouths with bevelled and overlapping lips; and their style of ornament consists for the most part of simple cords or bands of punctured zigzag and herring-bone work, intermixed with dots and small projecting bosses. The two vases repre-

Fig. 14.



Fig. 15.



Roman-British black glazed pottery, fig. 14 from Castor, fig. 15 from Water Newton.

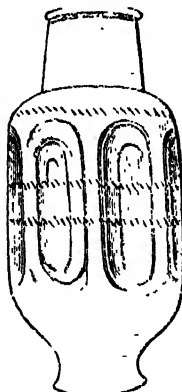
sented in fig. 16 (on the next page) exemplify, in a highly characteristic manner, this class of early pottery.

The following gives a general idea of the processes of the potter's art as practised in Staffordshire, its great English home:—

The materials for earthenware are reduced to the consistency of cream, in which state they are called *slips*

(slops); this fluidity is necessary to insure the perfect mixture of all the ingredients and their mutual chemical action in the fire. The basis of the composition is a clay from the plastic clay formation in Devonshire or Dorsetshire, to which is added ground flint, which gives whiteness and solidity to the goods. For the better kinds a portion of China-clay, or decomposed felspar from Cornwall, is added, together with a small quantity of ground white granite. By this means the density of the ware is increased, greater purity of whiteness is obtained, and also a degree of vitrification, which makes the ware sonorous when struck.

Fig. 13.



Roman-British glazed black pottery found in London.

The flints employed are burned in a kiln, slaked to destroy their coherence, and ground to powder in a mill constructed for the purpose. The powder is then sifted in water until reduced to a fit state for combination with the other substances. The clays are thrown into their several vats sunk in the ground, where they are blended with water, and sifted through fine silk lawns into other receptacles, and then diluted with water. The mingled flint and clay, in the state of a creamy liquid, is then pumped into a boiler or slip-kiln, the bottom of which is formed of large flat fire-bricks, under which four or five parallel flues pass from the fireplace to a high chimney. The water is then evaporated, until the boiling mass is brought to a proper consistency for working; but the steam having given it a cellular and porous texture, it requires to be

nare, was smothered upon the vessels when in the kiln, and it is supposed that the carbon was thus deposited on the heated surfaces of the vessels, giving them their black glaze. It must be added that occasionally vases have been found which are identical with the black Castor ware, with the sole exception that in colour they are of different shades of yellow and yellowish-gray. The ceramic relics exhumed from British tumuli, and from other sepulchral mounds of the same age, may represent but imperfectly the various kinds of pottery then in use, or the arts of the Romans would, indeed, seem to have passed away almost with the receding steps of the legions. The rudeness of the greater number of the specimens of old English pottery is indeed as remarkable as the tendency which it so generally exhib-

beaten or wedged until the air is driven out, and a section of the mass, when cut, is smooth and compact.

All the various kinds of ware, such as cream-coloured ware, drab-coloured ware, drab body, brown body, Egyptian black, blue body, jasper body, turquoise body, &c., are formed of different kinds and proportions of flint and clay, with small additions of colouring materials. Round articles, which may be turned upon a lathe, have their form given upon the thrower's wheel, which is a lathe with a vertical spindle, having a small round table on the top, at which

Fig. 16.



Early pottery of British or old English manufacture.

the thrower sits. He receives the clay prepared to the proper size by a woman, called the *buller*, and throws it upon the whirling table between his knees, which is put in motion by the wheel-woman, whose eye watches every motion of the thrower and regulates the velocity of the work with perfect accuracy. The thrower first draws the clay up into a pillar, then depresses it into a flat cake, until the whole mass has been drawn into a circular arrangement of all its parts. He then opens the hollow of the vessel with his thumbs, and continues to draw out the clay, or press it inwards, until the desired shape is given to it. It is then cut from the table by a brass wire, and placed on a board, which, when full, is carried into a stove-room to harden.

When a number of vessels of the same size are to be thrown a gauge is fixed so that its point just touches the top edge of the article when it is revolving; this fixes both the height and diameter of all that are made after.

When the vessels are sufficiently hardened they are turned upon a lathe similar to that used by wood-turners. The turner dexterously shaves away the clay to the proper thickness, and works the mouldings, &c., polishing the whole with a steel burnisher. He frequently ornaments bowls, jugs, &c., with a coating of various coloured clays, which are sometimes blended with each other, so as to give a marbled surface. By these earthy pigments he produces an infinite variety of patterns. This kind is called *dipped ware*.

Such articles as require handles and spouts are then passed to the handier, who makes those appendages in plaster moulds, and sticks them to the vessels with liquid clay. Plain handles are pressed by a syringe through a hole of the proper size and form, and as the clay comes through in long strings it is cut off, and bent into the desired shape for the handle.

Thrown and turned goods are sometimes ornamented with figures in relief, which are made out of flat moulds by children, and fixed upon the ware by workmen, who, having carefully adjusted each figure to its place, run a little water under it with a camel-hair pencil, which unites it to the surface of the pot. Goods of an oval or angular

shape, which cannot be turned, are made by pressing clay into plaster moulds, which give the outside form to the vessels: this is called *hollow-ware pressing*. Another kind, called *flat-ware pressing*, is performed by giving the shape to the goods by moulds which fit the inside of the vessel; plates, dishes, saucers, cups, and hand-basins are made on this principle.

Casting is resorted to when a mould is so intricate as to be difficult for the workmen to fill by pressing. Slip clay is poured into the mould, which rapidly absorbs the water; and a coating of clay is deposited upon the inside; the remaining fluid is then poured out or drawn with a syringe, and a thicker mixture is put in, and left rather longer than the first before it is withdrawn. The mould is then put into a stove to dry.

When completed by the workmen the goods are placed on boards to dry, before going to the biscuit-oven, in which they receive the first fire. The ware to be thus burnt is placed in *saggers*, or *seggars*, made of crucible clay; in shape they resemble hat-boxes, and being piled in columns each sagger covers the one beneath it, and protects the goods from the immediate contact of smoke and flame. When the baking is finished and the oven cooled, which takes about forty-eight hours for baking and forty-eight for cooling, the doorway is opened, the saggers brought out, and their contents submitted to a rigid scrutiny: all cracked and crooked pieces are rejected and thrown away. The ware is now called *biscuit*, and in this state goes to the printer or biscuit-painter to be ornamented.

The printing of earthenware is effected by transfer-papers from engraved copper plates. The ink used in printing is made of linseed-oil boiled with litharge, rosin, balsam of sulphur, or Barbauldes tar, and is tinted with any of the usual mineral colours—blue being the principal, and formed of oxide of cobalt. The colour having been ground very fine, the printer blends it with his oil upon a hot stove, and filling the engraved plate with it, takes off the impression by the common rolling-press. The tissue-paper used for this purpose is first prepared with a solution of soap. As soon as the print is taken a girl cuts out the

Fig 17.

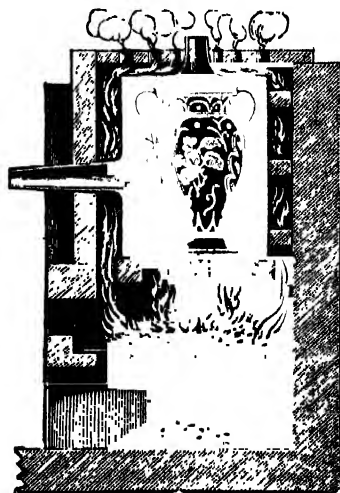


Diagram of a muffle furnace for firing porcelain.

engraving with scissors and hands it to the transferer, who carefully places the print upon the biscuit-ware, which, being absorbent, holds it with great tenacity. The transferer then passes it to her assistant, who, with the end of a cylinder of flannel, tightly rolled and bound with twine,

rub the print with such force as to work the ink into close contact with the biscuit. The goods thus coated with paper are then put into a tub of water, and the paper being wiped off with a sponge, every minute point of the engraving is found accurately transferred to the earthenware. When dry the goods are packed close in a large muffle or kiln (fig. 17), round which a fire circulates, and brings the whole to a low red heat. By this means the oil is burned out of the colour, which would be injurious to the process of glazing which follows. Some patterns are executed on biscuit by painters, who lay on the colours in gum-water.

The biscuit-ware, thus ornamented, is carried to the dipper, who dips each piece into the tub containing the finely-ground mixture which, when melted, forms the glassy coating of the ware. This glaze is blended in water, which, being absorbed by the biscuit, leaves a thin cover of glazing-powder upon the surface; a dexterous shake of each piece in a circular motion, as it emerges from the fluid, prevents the glaze from setting unequally, and throws off all that is superfluous. The material of the glaze differs according to the kind of ware: white-lead is a general ingredient. Much of the fine painting is done after glazing, and not directly upon the biscuit.

When the goods have been dipped in the glazing mixture they are dried, and placed in saggars, which are washed on the inside with a compound of glaze with lime and clay. Every piece is carefully placed so as not to touch another; otherwise, when the glaze melts, they would stick together. Thus prepared the batch is sent to the oven for firing. The value of the china and earthenware exported in 1885 was £1,729,192.

For fuller details the reader may consult Brongniart's great work, on which all the rest are more or less based, "Les Arts Céramiques" (Paris, 1844). Brongniart was the director of the Sevres manufactory. See also Marryat's "History of Pottery and Porcelain" (London, 1868); Birch, "Ancient Pottery," second edition (London, 1873); Jacquemart, "Histoire de la Céramique" (Paris, 1874); Eliza Meteyard, "Life and Letters of Josiah Wedgwood" (London, 1866); "The Ceramic Art," by J. J. Young (London, 1879); "Handbook of English Pottery," by Professor A. H. Church (London, 1885); and the handbooks of the South Kensington Museum.

POTTO (*Perodicticus potto*) is a species of *LORIS* belonging to the group *Lorinae*, of the family *Lemuridae*. The potto is about the size of a cat, with a stout body covered with long, soft woolly hair, short limbs, and a long tail. It is found in the forests of the coast of Guinea, and in other parts of tropical Africa. Like the Asiatic slow lemur, it is nocturnal in its habits, passing the day sleeping in the holes of trees and coming forth at nightfall to seek its food, which consists partly of fruits and leaves, partly of insects. The hand is remarkable, the index finger being reduced to a mere tubercle. The general colour of the body is a chestnut-brown, the under parts being paler, and the tip of the tail black. The head is rounded and the ears short. Another African species, the Angwantibo (*Perodicticus* or *Arctocebus calabariensis*), from West Africa and Old Calabar, has the tail almost wanting, and the index finger still further reduced. But little is known of its habits.

POTWAL'LOPERS (Eng. *pot*, and Saxon *wealen*, to boil), a name given to the Parliamentary voters in some English boroughs before the Reform Bill of 1832. It included theoretically all inhabitants procuring their own diet (i.e. potboilers). In practice every male inhabitant, whether housekeeper or lodger, who had resided six months in the borough and had not been chargeable to any township as a pauper for twelve months, was entitled to vote.

POUDRETTE (French), a manure made of dried night soil mixed with clay, charcoal, or gypsum, which

is largely used in Belgium, France, and some other parts of the world. It possesses great fertilizing powers, being rich in ammonia, phosphates, and potassa, and it is highly valued by the agriculturists of those countries where it is used. It is upon manure of this kind that the dense population of China chiefly depend for the fertility of their soil, though they do not prepare it altogether in the manner indicated. Some attempts have been made to introduce its use to the agriculturists of Great Britain, but for various reasons these have up to the present met with but little success. There is not the slightest doubt that some such use of sewage will become a possibility in the near future, as it has already become almost a necessity.

POUGHKEEPSIE, a town in the state of New York, United States, situated on the Hudson, on a plateau 200 feet above the river, 67 miles north of New York. The chief fame of Poughkeepsie, which is a well-built town, with regular and shady streets, arises from its collegiate establishments. Vassar College for ladies has a library of 15,000 volumes, an astronomical observatory, &c. The principal industries are iron-working, brewing, shoe, glass, and pottery making. The population in 1880 was 20,207. The town was founded by some Dutch families in 1735, and incorporated in 1801.

POULPE. See OCTOPUS.

POULTICE or **CATAPLASM** (Lat. *puls*, *pultis*, a thick pap; compare Gr. *pollos*, porridge), the name given to an external application of a soft moist character, used in medicine to apply heat and moisture externally, or to exert some specific effect by the action of a drug. Formerly a great variety of poultices were employed in medical practice, but at the present day only six are official, and some of these are but rarely used. The simple poultice, used chiefly to bring a moist heat to bear upon the part to which it is applied, is made from linseed meal, the best for the purpose being that from which the oil has been expressed, as the pure meal becomes rapidly rancid. The following has been recommended as a useful method of making a linseed-meal poultice:—Heat the basin in which the poultice is to be made with boiling water; then empty it and put into it again as much boiling water as may be necessary to make the required poultice; sprinkle the meal into the water, stirring vigorously till the proper consistence is attained; lastly, stir in a small quantity of olive oil. The poultice should then be quickly spread moderately thick upon a piece of soft rag, and applied as soon as the heat is bearable. A poultice of this kind should be changed every two or three hours during the day and every four at night, if the patient is sleeping. Formerly poultices of this kind were esteemed the best local applications for boils and other gatherings attended by free suppuration, but many practitioners now prefer to use wet boracic lint as a more cleanly and less irritating application. There are two disinfesting poultices recognized for fetid and gangrenous sores—the poultice of charcoal made of bread soaked in boiling water, linseed meal, and powdered charcoal, and that of chloride of soda, composed of one part of the solution of chlorinated soda, two of linseed meal, and four of boiling water, but they are now rarely used, their place having been taken by more efficient antiseptic applications. There are also two sedative poultices, one of doubtful value, composed of brewers' yeast, flour, and water, the mixture being allowed to ferment before application; and the hemlock poultice, composed of hemlock leaf in powder 1 oz., and linseed meal 8 oz., these ingredients being stirred into 10 oz. of boiling water. This poultice is used to relieve the pain of cancerous and scrofulous sores. The last of the official poultices is the ordinary mustard poultice, which is invaluable in many affections on account of its counter-irritant properties. See **MUSTARD**.

POULTRY (Fr. *poule*, a hen). The term poultry includes the whole of the domesticated birds reared for the sake of their flesh and eggs—fowls, turkeys, guinea-fowl, ducks, and geese. All these birds are noticed in separate articles, which deal with the wild species, their habits, and the domestic varieties to which they have given rise. The present article only offers some general remarks on the practical management of the domestic birds.

Rearing poultry, especially fowls, for the market is usually practised as an addition to the ordinary labour of a farm, or by cottagers in their own gardens. Poultry-farms, devoted exclusively to this industry, have not proved successful, from the difficulty of keeping a large number of birds free from disease. Fowls never succeed well where they are confined in a small space. As far as possible they should be allowed to follow their natural habits, running about in the open and finding their food for themselves. Where it is impossible to allow them so much liberty, a dry, warm, well-ventilated fowl-house should be provided, to which a yard or "run" is attached. The run should be well sheltered, with a warm aspect, sufficiently inclined to be always dry, and supplied with sand or fine ashes for the birds to roll in, an operation necessary to disengage their feathers from vermin; running water, especially if geese and ducks are kept, should form part of the poultry-yard. Lime and small stores must also be supplied, the former for the production of egg-shells, the latter to aid in the trituration of the food in the gizzard; mortar from walls will afford both. The perches in the hen-house for roosting should be low. Where possible it is well to allow the hen to make her own nest in a hedge, otherwise boxes or baskets should be provided, placed near or on the ground. Damp earth is the best material for the bedding to supply the necessary moisture and coolness. When hatched, the chickens should not be removed nor fed for twenty-four hours, as they are during that period nourished by the remains of the yolk taken into the body before their exit from the shell. The day after their birth they are fed with egg and milk, beaten together in equal quantities to form a custard; after that meal may be added and raw corn. Grain, chiefly barley and oats, forms a large part of the food of poultry, and is also largely used in the ground state; oatmeal, however, is too expensive for ordinary use, but is useful for young chicks and for fattening. Green food, such as lettuces, cabbages, swede turnips, &c., should form part of the food of poultry; and where sufficient opportunity does not exist for them to pick up their natural animal food—worms, grubs, and insects—the refuse from the kitchen may be supplied. In a confined space the cock should have five mates, and where several cocks are kept in the same yard, care should be taken not to have them of equal age and size, for in this case they are always jealous and quarrelsome. Sixteen eggs are sufficient for a hen to sit on. Artificial incubation by the aid of heat has been successfully practised.

Turkeys, though very delicate in their infancy, become hardy, and if permitted will roost on the highest trees in the cold dry nights of winter without suffering injury. The hen is a very steady sitter. The eggs are hatched after twenty-eight days' incubation. The young birds are fed with meal, egg and milk, lettuce, &c.; in a little while they can supply themselves in their ramblings so far as to require food only when leaving their house in the morning and returning at night. It is not necessary for the cock to be constantly with the hen during her period of laying, as a single visit from him is sufficient to impregnate all the eggs.

Guinea-fowl have retained more of their natural wildness than other poultry, and dislike the confinement of a house. A dry, warm locality is necessary for their successful rearing. The hen does not begin to lay so early as other poultry, and the first eggs are usually put under the con-

mon hen, a small variety for choice. The young require the same food as young turkeys, and are somewhat difficult to rear. The loud cry of these birds renders their maintenance objectionable near to the house. When designed for the table they should be killed at an early age.

The rearing of ducks is very profitable, from the readiness with which they find their own food, the number of the eggs laid, and the early age at which they are fit for the market. One drake is sufficient for five ducks. The eggs are very usually incubated by the common hen. For a short time after their birth ducklings should be kept from the water. They are fed at first on oatmeal and milk, afterwards oats thrown into a vessel of water are given, and abundance of grass is indispensable. By high corn-feeding in the winter the eggs are laid in the cold months, and ducklings fit for the market may be had in early spring. Ducklings intended for the market are never allowed access to the water, and are ready in from six to eight weeks.

Geese require more vegetable food than ducks; they can be fattened quickly on oats thrown on water; oatmeal and peas, with skimmed milk or buttermilk, are also used for fattening. In a mild spring the geese lays very early, and by good feeding in the winter months two broods may be had in the same year. The goose is a very steady sitter. The time of incubation is twenty-nine days. The goose is remarkable for the length of time she lives, and remains productive up to twenty-five years, and even later. ("The Poultry Book," by W. B. Tegetmeier, second edition, London, 1873.)

POUNCE, a preparation of finely powdered resin, of cuttle-fish bones, or gum copal, mastic, or sandarach, was formerly much used for sprinkling over writing while still wet, to prevent blotting. Fine sand was often substituted; but blotting paper has now entirely superseded the use of pounce.

POUND (Old English *pund*, an inclosure; *pond*, an inclosed piece of water, is the same word used in another sense), an inclosure erected by authority in which cattle or other beasts are confined when taken in trespassing or going at large in violation of law. A common pound is kept in every township, lordship, or village in England. It is compulsory for the impounder, in all cases, to supply the cattle with food, the expense of which he may recover from the owner.

POUND, the English standard value and standard weight. As money, after its first existence in the form of cattle (Lat. *pecus*, a herd, whence *pecunia*), came to be represented by a lump of one of the precious metals, the fact that the same word should serve for standard weight and standard value is not surprising. The French *livre* follows exactly the same equivalent. The two cases are, indeed, not merely similar, but actually the same, only that *pound* comes from one part of the full Latin phrase, and *livre* from the other. The Latin word *poundus* meant weight, and was derived from the root *pend-*, to hang, a root common to many of the Aryan languages, and probably in its most archaic form $\sqrt{\text{SPAN}}$; as the weight in the balance caused one of the scales to hang down it was called the hanger, i.e. *poundus*. *Pondo* would therefore mean by weight, and *libra pondo* a pound by weight. Such an expression as *Auri quinque libras pondo*, five pounds weight of gold, was usually shortened into "*Auri V pondo*;" and *pondo*, without any numeral attached to it, was frequently used as meaning one pound. Hence, from *pondo* we get our word, while the French take theirs from the more correct *libra*.

The pound weight in England was found to vary considerably. Consequently Edward I., in his practical way, settled it by statute in 1302. The pound Troy, originally a weight used at the fair of *Troyes* in France, was adopted by goldsmiths about 1497, and was divisible into 12 oz.

Troy of 480 grains each; that is, 5760 grains, equal to 373·21195 French grammes. The pound Avoirdupois (Fr., to have weight, the older *pois*—from Latin *pensum*—being the correct spelling, and the modern *poids* a corruption, the *d* being falsely inserted as if from *pondus*) was introduced about 1527, and speedily, from many causes, displaced the pound Troy from all but its original goldsmiths' uses, becoming itself the main weight of the country. It is divided into 16 oz., which must not be confused with the 12 oz. of Troy weight, for while the latter have 480 grains, each the ounce avoirdupois has only 437·5 grains. The grain is alike in both weights. The pound avoirdupois weighs 7000 grains (Troy pound=5760). The value of the pound avoirdupois, in French grammes, is 453·59265.

It may here be mentioned that the Troy system of weight by grains, pennyweights, ounces, and pounds, though the exact pound weight we now call Troy was not introduced for nearly two centuries later, was the ancient and original English system. It was regulated carefully by the 31 Edw. I. (1302), already mentioned, the main provisions being as follows:—

(1) An English *penny*, now the largest coin in England, which is also called a *sterling*, round and without clipping, shall weigh 32 *grains*; that is, grains of wheat, well dried, and gathered out of the middle of the ear.

(2) And 20 of these pence (or pennyweights) shall make an ounce. (3) And 12 of these ounces shall make a pound.

The pennyweights were subsequently divided into twenty-four grains. The penny was of course of silver, and at this time was a little larger than our present threepenny piece. The pound was not identical with the French *Troyes* pound, but was lighter by three-quarters of an ounce Troy. It continued to be used, this ancient pound of Edward I., in the royal mint, and as this was located in the Tower it was called the "Tower pound" or "moneys' pound." Henry VIII. abolished the Tower pound in favour of the pound Troy in 1527. The Tower pound is seen to be to the pound Troy as fifteen to sixteen, so that weights of the first have to be increased by a fifteenth to get weights of the second. All early money must be dealt with in this manner in ascertaining its value.

Pound sterling.—This is the principal English coin of account, and is accurately measured by the coin called a *SOVEREIGN*. It contains 20 shillings or 240 pence, and weighs 123·27447 grains Troy, or 7·98805 grammes; so that forty pounds Troy of gold is coined into 1869 sovereigns.

The name pound is derived from the fact that in the time of the Conqueror one pound of silver (Tower pound) was coined into 240 silver pence, so that the Tower penny-weight was actually the weight of a penny. Twelve such pence made a shilling (or rather a *solidus*), and twenty *solidi* a pound. The weight of the shilling was reduced from time to time, till in the reign of Elizabeth the pound (pound Troy now, altered by Henry VIII., as said above) was coined into 744 pence, instead of 266, as it should have been at the old rate of 240 to the Tower pound; but twelve of the smaller pence still made the shilling, and twenty shillings the pound. The pound was thus seriously reduced in value in comparison with the value of bullion.

Other pounds of value are the following:—(1) The Channel Islands pound, worth only 280·4 pence English money (£1 sterling=£1 1s. 8d., Channel Islands currency). (2) The Canadian pound, called Halifax pound, a coin of account only, equal to four Canadian dollars, which are assumed to be worth fifty pence English each (sixty pence Halifax currency), making the Halifax pound=16s. 8d. English. The English pound sterling is used in government accounts, but not elsewhere. The pound in New Brunswick currency, and that in Newfoundland currency, are also, like the Halifax pound=16s. 8d. English. (3) The pound Nova Scotia=16s. only.

POUND/AGE, one of the ancient taxes of England. See *TONNAGE* AND *POUNDRAGE*.

POUSSIN, NICOLAS, was born near Le Grand Andely, in Normandy, in 1594, of a noble but reduced family. An artist, named Quentin Varin, taught him the rudiments of painting, and in Paris he received lessons from Ferdinand Elle, a Flemish portrait-painter. In 1624 Poussin went to Rome, where, after having to contend against many pecuniary difficulties, he was liberally patronized by the Cardinal Barberini, for whom he painted his celebrated picture of the "Death of Germanicus," and the taking of Jerusalem by the Emperor Titus.

The celebrity which the artist had now attained induced Louis XIII., in 1639, to desire his return to France, which took place in the following year, when he was appointed principal painter to the king, and had apartments assigned him in the Tuileries. The criticisms of his brother artists, however, upon his subsequent works, excited his disgust, and in 1642 he quitted his country with a determination never to return. He resided in Rome, passing his time in diligent practice of his art, and in the strictest simplicity of living, until 1665, when he died. The National Gallery possesses seven excellent examples of Poussin, two of them classed among his finest works. Some fine pictures by Poussin are also in the Belvoir Castle Collection. He may be without hesitation ranked as the first of classical French painters.

POUSSIN, GASPARD, was born at Rome, in 1613. His family was French, and bore the name of Dughet, but Nicolas Poussin having married his sister, he acquired the appellation of Gaspar Poussin. He studied under his brother-in-law, by whose advice he adopted landscape painting, and soon became one of the most celebrated practitioners in that branch of art. His pictures are sometimes embellished with figures by Nicolas Poussin, usually representing some subject of history or fable. There are a few slight but masterly etchings by this great artist. Six favourable examples are in the National Gallery. Most of Gaspar's subjects are taken from the environs of Rome. He died at Rome in 1675.

POUT, WHITING-POUT, and BIB, are the various names given to *Gadus luscus*, a small fish belonging to same family (*GADIDÆ*) and genus as the COD. It is found on British coasts, and is abundant in places round the Atlantic coasts of Europe, but is rarer in the Mediterranean. The pout is distinguished by its deep, short body, short, blunt snout, and the presence of a long barbel on the chin. The body is marked with transverse bands, and there is a black spot in the axil of the pectoral fin. It rarely exceeds a weight of 5 lbs. The flesh is considered good if eaten soon after capture.

POWAN (*Coregonus clupeoides*) is a species of *SALMONIDÆ* peculiar to the lakes of Great Britain, and within these limits confined to the lakes of Cumberland, Lake Bala in Wales, and Loch Lomond in Scotland. In Loch Lomond, where they are known as fresh-water herrings, they occur in great shoals, and are caught with the drag-net from July to September. The powan occasionally attains a length of 16 inches. It is much esteemed for the table. In the Cumberland district it is called "Schelly," and in Wales "Gwyniad." See *COREGONUS*.

POWER. In algebra the fourth power of x means the product of four x 's or $x \times x \times x \times x$; and the same of other powers. But it is far more symmetrical to begin from unity, and to say that the fourth power of x is the result of four multiplications by x , unity being understood as the commencement. Thus the successive powers of x , first, second, third, &c. are $1 \times x$; $1 \times x \times x$; $1 \times x \times x \times x$; &c.: denoted by x^1 , x^2 , x^3 , &c. And the term *root* is the inverse of power, as follows:—If A be the m th power of B , B is the m th root of A , denoted by $m\sqrt{A}$. The small number expressing the order of the power or the

root is called the index or the exponent. The second power is always called the square ($x^2 = x$ square), and the third power is called the cube ($x^3 = x$ cube).

To multiply one power of a magnitude by another of the same, add the indices; to divide, subtract one index from the other. Thus $x^2 \times x^3 = x^5$; $x^3 \div x^2 = x$.

Many curious observations have been collected on the subject. There is only space for one or two here.

Number of digits in Squares and Cubes.—As the squares of all numbers less than 10 are less than $10 \times 10 = 100$, it is evident that the squares of all numbers of one digit have either one or two digits; also, as the squares of all numbers less than 100, and not less than 10, are less than 10,000, and not less than 100, it is plain that the squares of all numbers of two digits have either three or four digits; and generally "the square of a number expressed by a given number of digits contains either double of that number of digits, or double of that number less one." For example, the square of a number expressed by five digits (that is, less than 100,000 and not less than 10,000) contains either ten or nine digits (being less than 10,000,000,000, and not less than 100,000,000).

In like manner, as the cubes of all numbers less than 10 are less than 1000, it appears that the cubes of numbers of one digit have either one, two, or three digits; also, as the cubes of numbers less than 100, and not less than 10, are less than 1,000,000, and not less than 1000, it appears that the cubes of numbers of two digits have either four, five, or six digits; and generally the cube of a number expressed by a given number of digits contains either treble that number of digits, or treble that number less one, or treble that number less two. For example, the cube of a number expressed by three digits (that is, less than 1000, and not less than 100) contains either nine, or eight, or seven digits (being less than 1,000,000,000, and not less than 1,000,000).

The square, cube, or any other power of a number which is the product of two or more factors, is the product of the squares, cubes, or other corresponding powers of those factors. To take an example at random, let the root be $30 = 2 \times 3 \times 5$. Then its square is—

$$\begin{aligned} 30^2 &= 30 \times 30 = 2 \times 3 \times 5 \times 2 \times 3 \times 5 \\ &= 2^2 \times 3^2 \times 5^2; \end{aligned}$$

its cube is—

$$\begin{aligned} 30^3 &= 30 \times 30 \times 30 = 2 \times 3 \times 5 \times 2 \times 3 \times 5 \times 2 \times 3 \times 5 \\ &= 2^3 \times 3^3 \times 5^3. \end{aligned}$$

Among the immediate consequences of this proposition are the following:—

The powers of an even number are all even; those of an odd number are all odd.

If a given root be exactly divisible by a certain number, every power of that root will be exactly divisible by the corresponding power of that divisor, and by every lower power. For example, 12 being exactly divisible by 3, it follows that 12^2 is exactly divisible by 3^2 and by 3, that 12^3 is exactly divisible by 3^3 , 3^2 , and 3, and so on.

POWER is a term applied to any cause which is capable of producing motion, or of resisting motion; but the word has a merely technical meaning in treatises of mechanics. From among the numerous combinations which occur in machinery, the lever, inclined plane, wheel and axle, pulley, wedge, and screw, have been selected, and named mechanical powers, apparently because they are the simplest objects by which are produced such effects as could not be produced by the unassisted or unadapted operations of a motive agent, as gravitation, muscular strength, &c. The word power here may be conceived to signify that which produces a mechanical advantage; but the same word may be used to signify a beneficial effect, as when a thing is done quicker or better at an equal expense of labour or

time. The mechanical advantages of simple machines are shown in the articles LEVER, WHEEL AND AXLE, MECHANICAL POWERS, &c.

Beneficial effect may be produced in various ways without mechanical advantage; for example, in the division of labour there is not only the moral benefit, namely, the making a human agent fitter for his work by giving him a more limited range of operations, but the actual saving of the physical and mental effort involved in laying down one tool and taking up another.

The muscular power of men and animals, the force of winds, the fall of water, the expansive power of steam, and the attractive power of electricity, are real powers, the explanations of which lie in the secrets of the laws of life, gravitation, and chemistry. A machine is an adaptation of material elements to one or more of the real powers just mentioned.

POWER OF ATTORNEY or **LETTER OF ATTORNEY.** Power, in law, means an authority given to some one to do an act which, without the authority, he would not be entitled to do. A power of attorney is a writing authorizing another person, who in such case is termed the "attorney" of the person appointing him, to execute any document or do any lawful act in his stead. A power of attorney is either general or special, revocable or irrevocable, according to the terms thereof. Powers of attorney may now be deposited and filed at the Central Office of the Supreme Court; and office copies thereof are to be received in evidence without further proof.

POWER, THE EMOTION OF, is one of the most subtle of our pleasures, and perhaps one of the most dangerous. It arises, moreover, from so many sources that few are without its temptations. It is distinct from the joy of success, and is not dependent upon pleasurable effort, though both the one and the other enter into it for the most part. It consists, whatever may be its origin, in the consciousness of superior force to some other person or set of circumstances, or even the consciousness of superior force to oneself at a weaker moment. It is so acutely pleasurable that children, and even youths, shout with laughter at its sensation, while grown men hold themselves proudly erect, and delicate women flush with the intense excitement. For power is not limited to muscular or even to mental power. The force of character, the inspiration of genius, the electric thrill of the orator, the magic of a lovely face, or a sweet smile, or a gracious movement, or an exquisitely tasteful act, or a perfect costume, are equally sources of the emotion. The sheer tyranny of the slave-driver, the brutal contest of the prize-fighter, the power to degrade and crush which wealth gives to the unworthy, gratify the sense of power as well as the enthusiasm of the revered statesman who compels a nation to listen to his every word, the heroism of the life-saving fireman or muscular life-boatman, and the beneficent money-power in the hands of the philanthropic nobleman. Ambition, "the last infirmity of noble minds," is fed by the cravings for this all-mastering emotion: it rests with us only to choose the form of power we will aim at, the existence of the emotion in some shape or another being a necessity of our nature.

That this is so is proved by the intensity of the corresponding pains. Hamlet runs almost wholly upon them as the chief miseries of life—

"For who would bear the whips and scorns of time,
Th' oppressor's wrong, the proud man's contumely,
The insolence of office, and the spurns
That patient merit of the unworthy takes,
When he himself might his quietus make," &c.

To be beaten, especially unjustly, to be dependent, to taste "how salt is a patron's bread, how steep a patron's stair," as Dante puts it in bitter self-revelation, to suffer scorn and contempt, to see the less worthy or the dishonest pre-

ferred over our heads, prove, by the darkness of the shadow of impotence which at such times enwraps us, the blaze of the light of power.

POYNINGS' ACT. See POYNINGS, SIR EDWARD. **POYNINGS, SIR EDWARD**, a native of Kent, was appointed deputy of Ireland by King Henry VII., in 1494, with special instructions to suppress the revolt of Perkin Warbeck's partisans. Taking a thousand men with him, he landed in Ireland in the month of September, and proceeded at once to vigorous action against the disaffected. Many districts in Ulster were laid waste. Carlow was besieged and taken. In November he convened the celebrated Parliament of Drogheda, which annulled all the Acts that had been passed in favour of Lambert Simnel, the first pretender to Henry's crown. Other important statutes were passed by this Parliament. In the month of January, 1495, Poynings was recalled and rewarded for his prudent government of Ireland with the order of the Garter. Henry VIII. made him a privy councillor and governor of Tourain in Flanders, then recently conquered. The act passed by the Parliament of Drogheda, which is known as *Poyning's Act*, was to establish the illegality of any meeting of Parliament of which the king should not be previously apprised, and the introduction of any bill into the Irish Parliament unless it had already met with the approbation of the English council.

POZZUOLANA. See PUZZUOLANA.

POZZUOLI, the Roman *Puteoli*, an ancient town of Campania, situated on the eastern shore of the Gulf of Gaeta, 5 miles west from Naples, from which it is separated by the hill of **POSILLIPO**, through which a tunnel was excavated in ancient times. Pozzuoli lies at the foot of the volcanic hill called *La Solfatara*, and on the western side of it is another volcanic hill called *Monte Nuovo*, which was thrown up in one night in September, 1538, on the site of the Lucrine Lake. *Puteoli* was a flourishing place under the Romans, being resorted to by the wealthy for the sake of its situation and its mineral springs. It is now decayed, but the remains of antiquity attract numerous travellers. St. Paul once spent seven days here (Acts xxviii.) Pozzuoli gives the name to the fine cement, formed of a reddish coarse volcanic ash, called *puzzuolana*.

PRACTICE, a rule of arithmetic, appropriately so termed because it hardly contains any distinct principle, but depends for its application upon the memory and dexterity which the operator acquires from practice, especially in familiarity with fractional parts of a pound and a shilling. Thus, in the following simple question, "How much do 40 yards cost at eightpence a yard?" some arithmeticians (unpractised) might find it necessary to multiply 40 by 18 and divide the result by 12 for the number of shillings in the answer; but a practised arithmetician would immediately see that 18*d.* is a shilling and a half, and $1\frac{1}{2}$ times 40 shillings at once gives the answer, 60 shillings. Again, to find the value of a number of articles at half-a-crown each, one has only to divide by 8 to get the answer in pounds, since 2*s.* 6*d.* is the eighth of 20*s.*: to find their value at $1\frac{1}{2}$ *d.* each, one would divide by 8 and get the answer in shillings, and so on.

PRÆFECT (Lat. *praefectus*) was the name given to the custodian of the city of Rome in the absence of the king. He was *custos urbis* and prince of the senate. Under the republic the praefect, still continuing to be the warden of the city, was made a magistrate, and the office retained its old dignity, none but persons of consular rank being elected to it. The praefect ruled for the consuls if absent, as, in regular times, he had ruled for the king. This function, however, disappeared when the office of **PRÆTOR** was created, and, in fact, the new office absorbed the old one. The title still continued, but the later praefects had very little power. Under Augustus the praefect was a permanent magistrate who kept order in the city, especially

in the markets, theatres, &c.; in fact, he became what we should now call a commissioner of police. Time brought about its revenges, for during the empire the office of praefect grew in importance, till it absorbed all the chief duties of the *praetor urbanus*, just as the latter on its first institution had swallowed up the original *praefectus urbi*.

PRÆFECTUS PRÆTORIO was the title of the commander of the famous **PRÆTORIAN** Guards. The office became one of immense importance with the rise of the power of the *Prætorians*, and not only was a sort of command-in-chief, but had large and important judicial functions attached to it. The famous lawyer *Ulpian* served this office, for instance.

PRÆMUNIRE is, under the English law, the offence of treating the sovereign or his government with contempt, and which renders the person or persons so offending liable to forfeiture and imprisonment. The law was first instituted by Edward III. in 1353 to repress the papal encroachments on the power of the crown. It forbade the judgments of the king's courts to be questioned by the king's subjects in foreign courts under very heavy penalties: the "foreign courts" meaning of course, in especial, the ecclesiastical courts of the Pope at Rome. In 1365 publication of a Papal bull or brief in England, other than through the king's officers, was made an offence of *praemunire*. The great Statute of *Præmunire* (so called from its first word) is, however, that of Richard II. in 1393, embodying the previous legislation and largely extending it. It included attempts to procure bulls, &c. In later times various other offences have been rendered liable to the penalties of *praemunire*, such, for instance, as the asserting, teaching, or preaching that any person other than those selected by the Act of Settlement has any right to the throne, or that the sovereign and Parliament cannot make laws to limit the descent of the crown. Performing or assisting in any marriage forbidden by the Royal Marriage Act would also subject a person to the penalties of *praemunire*, and so would the refusal to elect a person already chosen by the crown as bishop of a diocese. The penalties are outlawry, forfeiture, and imprisonment during pleasure.

PRÆNO'MEN. See NAMES OF PERSONS.

PRÆTOR, a word which apparently contains the same elements as the verb *præire*. The consuls were originally called *prætors*, but the name was later on specially appropriated to a magistrate called the *Prætor Urbanus*, who was first appointed B.C. 365. He was called a colleague of the consuls, and was created under the same auspices. At first he was only chosen from the patricians. In the year B.C. 337 the first plebeian *prætor* was admitted. The *prætor* had six lictors.

He exercised the consular power in the city while the consuls were at the head of the armies in the field, but his great function was to preside over the administration of the law. In B.C. 247 a *Prætor Peregrinus* was created, who administered justice in matters between citizens and foreigners, and between foreigners (*peregrini*) only. When the Romans made conquests beyond the limits of Italy, new *prætors* were made to govern them. Two new *prætors* were appointed (B.C. 227) for Sicily and Sardinia respectively, and subsequently two others for the two provinces of Spain. The *prætors* generally spent their year of office in Rome, and then took the government of a province with the title of *Proprætor*. Sulla increased their number to eight. The *prætor urbanus* always held the highest rank. The number was again increased by C. Julius Cæsar; and finally, under Tiberius, it was fixed at sixteen. Others were subsequently appointed for various purposes, for instance, a *prætor* who had jurisdiction in trusts (*fidei commissaria*).

The *prætores*, *urbanus* and *peregrinus*, had the *Jus Edicendi*, or publishing of edicts, which (more particularly

(the *edicta* of the prætor urbanus) were the foundation of that large body of law called the *Jus Honorarium* or *Prætorium*, or briefly the *Prætor's Edict*, which each successive prætor published, with his own additions and corrections, on entering his year of office.

PRÆTORIANS, in the time of the Roman republic, was the name of a select cohort which attended the person of the prætor or commander of a Roman army. Augustus formed the Prætorians into nine cohorts, and stationed them in Rome as guards to his person. These soldiers became, under the empire, something like the guards or household troops in the kingdoms of modern Europe. They were commanded by a *præfectus prætorio*. In the frequent revolutions of the empire the Prætorian Guards acted a conspicuous part, and often determined the fate of an emperor and the choice of his successor. At least on one occasion they actually sold (to Didius Julianus) the imperial dignity for money.

Augustus had about 10,000 of these picked troops, 3000 or 4000 only of whom he kept at Rome, with his usual caution. Tiberius, his successor, initiated the fatal practice of collecting the whole body there. Their fortified camp, covering a large space of ground, lay just beyond the Servian wall of the city, separated by the wall from the great baths of Diocletian, when these were afterwards built, in fact where the present railway station stands. They served sixteen years, and on retirement obtained a donation of 20,000 sesterces in lieu of pension, say nearly £200 of our money. They had double pay and many privileges during service. Their permanent power over political matters has never been equalled by any body of soldiers save the Janissaries of Turkey. At each accession they received enormous bribes, called "donatives," to secure their attachment to the new sovereign. Severus disbanded them (A.D. 193) for the murder of Pertinax, and recreated them on a new model, raising them at the same time to 40,000 men. Later emperors even increased this number. Finally, their fidelity to Maxentius in 312 caused their conqueror, Constantine the Great, to determine upon their entire suppression; and they were distributed among the regular army.

PRÆTORIUM, originally the name of the general's tent and inclosure in the Roman pitched camp, which was always constructed on an elaborate and invariable plan. The *prætorium*, which we might translate "headquarters," was always pitched athwart the great avenue which divided the camp from the Prætorian gate to the Decuman, and the camp of the allies lay between it and the Prætorian gate, the Roman army between it and the Decuman gate. The great avenue from side to side of the camp, 100 feet wide, passed between the prætorium and the cavalry of the Roman legions. Facing the avenue, one on each side of the prætorium, were the *quæstorium* (military chest) and the *forum* (assembly hall). The chief officers of the army—that is, the staff, or council of war—were also collectively called the prætorium. The same name was given to the great camp of the Prætorian Guards, just without the walls of Rome. The word hence came to mean the seat of government when the Romans were away from home, and so was applied to the residence of any governor of a province. Thus we have a noble picture by Doré of "Christ leaving the Prætorium" (of Pontius Pilatus) at Jerusalem.

PRÆTORIUS, MICHAEL, the Latinized name of Michael Schulz (Schultheiss in German, being fairly translatable by Prætor in Latin), a musical composer and antiquary. He was born in Thuringia in 1571, served as Kapellmeister (bandmaster) to the Duke of Brunswick, was nominated prior of the monastery of Kieselheim, and died at Wolfenbüttel in 1621. The compositions of Prætorius are long since forgotten; but he has left a very valuable "*Syntagma Musicum*" (treatise on music), which is now rather rare, and which contains information other-

wise utterly lost. There are three vols. The first, published at Wittenberg in 1615 in Latin, with German notes interspersed, deals with ecclesiastical and ancient music, including careful descriptions of ancient instruments as far as the knowledge of the author went. This is now largely superseded. The second volume was printed at Wolfenbüttel in 1618, entirely in German. It describes all the then existing musical instruments, and treats of their peculiarities of tone, &c., one part especially dealing with the organs of the period; and this is accompanied with forty-two plates in a separate cover (1620). Its great value is evident, because the two centuries and a half which have elapsed since its publication have witnessed the entire destruction of nearly all that is there so carefully described; and sufficient measurements, &c., are given for complete understanding of the mediæval organ and orchestra. For example, it becomes easy to prove with accuracy the pitch of the mediæval church music by means of Prætorius and the lengths of organ-pipes which he gives. The third volume of the work (Wolfenbüttel, 1628) describes all kinds of composition then in use in secular music, with the intricate methods of time used in the middle ages (very valuable), and practical rules for voice-training and choral instruction, &c.

PRAGMATIC SANCTION, a term which has been used to signify a solemn ordinance or decree of the head or legislature of a state issued as a fundamental law. Its use appears to have originated with the Byzantine Empire, the edicts of the Eastern emperors having been called "pragmatics." In European history the name is used to designate (1) a celebrated document containing six articles directed against the papacy, known as the Pragmatic Sanction of St. Louis, but the genuineness of which is doubtful; (2) an ordinance issued by Charles VII. of France in 1438 in consequence of the schism in the church between the Council of Basel and Pope Eugenius IV., which tended considerably to diminish the power of the papacy, and was, in fact, the foundation of the liberties of the Gallican church; (3) the instrument by which the Emperor Charles VI. in 1713 vested the Austrian succession in his male or (failing such) his female descendants, with reversion to the daughters of his brother Joseph and their male and female offspring, in accordance with the law of primogeniture; and (4) the law of inheritance by which Charles III. of Spain in 1759 abdicated the throne of the two Sicilies in favour of his third son and his descendants. Of these different instruments the most celebrated is the third, which is often referred to as "the" pragmatic sanction.

PRAGUE (Ger. *Prag*; Slavonic, *Praha*), the capital of Bohemia, is situated 250 miles N.N.W. from Vienna, by railway, and 75 miles S.S.E. from Dresden. The town is built on the banks of the Moldau, in a valley and on the slopes of the hills that inclose it, the houses rising in tiers from the water's edge. It is about 12 miles in circumference. In size and beauty Prague is the third city in Germany, and produces a very striking effect when viewed at a distance. Its commanding situation, the lofty steeples of its numerous churches, its peculiar architecture, and the many domes and turrets of its fine palaces and public buildings give it quite an Oriental aspect. The city consists of four quarters—the old town, which is gloomy and closely built, with very high, old-fashioned houses, and which includes the dirty Jewish quarter; the new town, which surrounds the old town, and has finer and broader streets, spacious squares, lower houses, and a healthy site; the Kleinseite, which stands in a semicircular valley on the left bank of the Moldau, between two hills called the Laurenzberg and the Schlossberg: this quarter is smaller than the old town, but contains many gardens, fine palaces, and lofty houses; and the Hradschin, which is built on the Schlossberg: this is the smallest but finest part of the city, and contains a great number of magnificent palaces,

among them being the ancient residence of the Bohemian kings, which is a massive and imposing structure. The town of Wisschrad, which joins the new town, and the village of Smichow, on the left bank of the Moldau, are reckoned as parts of Prague. There is likewise a modern suburb called the Karotenenthal, which has some fine buildings, numerous gardens, and manufacturing establishments. Prague was formerly surrounded with fortifications, now mostly removed. The citadel is very strong, and from its elevated position thoroughly commands the city. The old town and the Kleinseite are connected by a modern chain bridge, and by an ancient stone bridge of sixteen arches. This last, which was commenced by Charles V. in 1538, is 619 yards long, 35 feet broad, and 42 feet high; it is adorned with twenty-nine statues and groups of saints, and has an ancient tower at each end. There are in the city fifty-five Catholic and three Protestant churches, ten synagogues, fifteen monasteries, and sixty-eight palaces. The metropolitan Gothic church of St. Veit, in the Hradschin quarter, which was commenced in the tenth century, but not completed till 1500, has a steeple 314 feet high, from the top of which there is a magnificent view of the city. This cathedral, in which are the sepulchres of several emperors, Bohemian kings, princes, and remarkable men, has twelve richly-adorned chapels, and contains paintings of the fourteenth century, besides numerous antiquities and relics. The great ornament of the cathedral is the monument of St. Nepomuk, the patron saint of Bohemia, a silver shrine weighing 37 cwt. Another remarkable old church is the Theinkirche, which dates from the ninth century, and contains the tomb of the astronomer Tycho Brahe. Many of the more modern churches, which are chiefly in the Italian style, and like them contain numerous fine paintings and ornaments, are worthy of attention. Among the palaces, the imperial palace in the Hradschin is the most remarkable building in the whole city, both for its immense extent and its fine and commanding situation. King Charles X. of France and his family resided for some years in this palace, after their expulsion from France. Other principal public buildings are—in the old town, the town-house, with a remarkable clock; the royal library, observatory, and many scientific establishments; the buildings of the old university, the church of St. Gallus, in which Huss preached; the Collegium Clementinum, built by the Jesuits, in which Joseph II. placed the archiepiscopal seminary; the theatre, the mint, and several palaces, among which is one which belonged to the famous Wallenstein: in the new town, the splendid theatre, the senate-house, the custom-house, and the military hospital: in the Kleinseite, the artillery barracks, arsenal, and the government house: and in the Hradschin, the archbishop's palace. In the Jewish quarter is a synagogue, which is believed to be the oldest in Europe. Here also the Jews have a town-hall and magistrates of their own. The royal armoury is in the town of Wisschrad, and in the village of Smichow is a botanic garden.

The Carolinum of Prague is the oldest university in Germany. It was founded in 1348 by Charles IV. on the model of that of Paris. Connected with it are a veterinary school, a school for midwifery, five clinical institutions, zoological and anatomical collections, a botanic garden, a chemical laboratory, and an observatory. There are three gymnasias, several other schools, a Polytechnic Institution, an Academy of the Fine Arts, a Musical Conservatory, an Academy of Sciences, and Bohemian National Museum, founded by Count Colowrat, with important collections and libraries. The Strahow monastery has a library of 50,000 volumes. The university library, which consists of 180,000 volumes and 4000 rare MSS. of classical and Slavonian literature, is kept in the Collegium Clementinum: there are besides eight public and several private libraries open for public use; and an Imperial Cabinet of Natural

History. The hospitals and charitable institutions for the reception and relief of the poor are numerous and admirably conducted. There are asylums for the blind, for deaf mutes, and for lunatics. Numerous public gardens and beautiful walks in the suburbs, and several royal and noble parks, which are open to the public, in the vicinity of the city, afford ample resorts for health and out-door recreation.

The manufactures consist of cotton, linen, woollen, osiery, silk, leather, hats, gloves, earthenware, jewelry, and plated goods, mathematical and musical instruments, glass, buttons, snuff and tobacco, paper and paper- hangings. There are also breweries, saltpetre works, and many other industrial establishments. Three great annual fairs are held in Prague: it is the centre of the commerce of Bohemia, and its transit trade is considerable. The latter is facilitated by the navigation of the Moldau, and by lines of railway which connect the city with Olmütz and Vienna on the east and south, and with Pilsen on the south-west.

Prague is an ancient city, but the time of its foundation is uncertain. It was the birthplace of the reformers John Huss and Jerome of Prague, and has suffered frequently by the calamities of war, especially in the religious troubles of the fifteenth century. In 1620, in the contest between the elector palatinate and the emperor for the crown of Bohemia, a battle was fought on the White Hill, 2 miles from the city, in which the imperial troops were victorious, and the Elector Frederick V., son-in-law of James I. of England, lost the crown. In 1744 the Prussian Frederick II. (the Great) got possession of the city, but was obliged to evacuate it in the following year. In 1757 Frederick again besieged Prague, but the victory of the Austrians at Collin obliged him to retire. On the 29th of May, 1848, the Czechs revolted against Austria, and appointed a provisional government. From the 12th to the 17th of June there was desperate fighting between the Czechs and Germans; on the latter day the military, under Prince Windischgrätz, retired to the Hradschin, from which they bombarded the rest of the town. The insurrection was ultimately quelled, but not before the perpetration of the most atrocious cruelties. The treaty of peace between Austria and Prussia, at the close of the Ten Days' War in 1866, was signed at Prague. The population of the city in 1880 was 162,318.

PRAIRIE DOG (*Cynomys ludovicianus*) is a species of MARMOT (Arctomyine) inhabiting the prairies of North America east of the Rocky Mountains. It is about a foot in length exclusive of the tail, which measures 4 inches. In colour the prairie dog is reddish-brown on the upper surface, whitish beneath; the tail is tipped with black. The common name is derived from its habit, when alarmed, of uttering a peculiar barking cry, which has been compared to that of a small dog. It is gregarious in its habits, living in deep burrows, which, in favourable situations, are collected together in such numbers as to form a "village" or "town." The entrance of each burrow is occupied by a little mound of earth, on the summit of which the occupant is often to be seen sitting. The prairie dog feeds chiefly at night on roots and grasses. Its burrows are frequently occupied by a small owl, the Burrowing Owl (*Athene cunicularia*), and by the rattlesnake. It was formerly supposed that these three animals lived together on amicable terms. As far as regards the owls this may be true, for from the pellets of undigested food which they cast up it is known that they feed chiefly on insects. The rattlesnake, however, preys upon the prairie dogs, so that its presence in the "town" is usually to be accounted for by its having devoured the rightful owner of the burrow. A second species of prairie dog, *Cynomys columbianus*, is found on the banks of the Columbia River. It is a smaller species with a shorter tail, which has a white tip.

PRATINCOLE (*Glareola*) is a genus of birds belonging to the Plover family (*Charadriidae*). The Common Pratincole (*Glareola torquata*) breeds in many parts of Southern Europe, and is an occasional visitor to the British Isles. It is a small bird with a short bill and very wide gape, long, narrow, and pointed wings, and a forked tail. With much of the appearance on the wing of the swallow, the pratincole possesses that rapidity and power of flight for which the bird is so remarkable. It takes its food, which consists of insects, and especially such as frequent marshes and the borders of rivers, while on the wing, darting along in the chase with the rapidity of an arrow; nor is it less distinguishable for celerity on the ground, and often catches its prey as it nimbly runs along. This elegant and graceful bird incubates in the concealment afforded by reeds, osiers, and tall herbage, laying three or four eggs. The young, like those of the plover, are able to run as soon as they are hatched.

A second species, *Glareola melanoptera*, distinguished by its black wing-coverts, also occurs in South-eastern Europe, extending further east. Several other species are known from India, Africa, and Australia.

PRAWN (*Palaemon*) is a genus of crustaceans, belonging to the long-tailed section (*Macrura*) of the order DECAPODA, which includes also the lobster, crayfish, and shrimp. The prawn is readily distinguished from the shrimp (*Crangon*) by the long serrated beak or rostrum which projects in front from the carapace. In all essential characters it is a lobster or crayfish in miniature. The Common Prawn (*Palaemon serratus*) is common on British coasts, being taken in enormous numbers on the south coast of England. When young they approach near the shore, and are often taken in shrimp nets and sold as shrimps. When full grown the prawn is between 3 and 4 inches in length, of a bright gray colour, with darker spots and lines. It is greatly esteemed for the table. It is usually taken in osier-baskets, similar to those employed for the capture of lobsters; but nets are also used. Its voracity renders it somewhat unsuitable for marine aquaria. Some of the exotic species attain a large size, and are beautifully marked.

PRAXITILES, renowned as a statuary in bronze, and the greatest of the Greek sculptors in marble, is assumed to have been a native of the island of Paros, famed for its marble quarries. He lived a generation or more later than Pheidias, was the contemporary of Lysippos and Apellès, and may have been born about 410 or 400 B.C., being already distinguished about 370 B.C. Some of the most popular remains of antiquity are associated with the name of Praxitès, though upon no positive grounds. He was distinguished for figures of Eros and of Aphroditè, and the beautiful Eros of the Capitol at Rome, now only a fragment, and the Aphroditè or Venus de' Medici are both assumed to be by, or from originals of, Praxitès. The far-famed Venus of Cnidus, for which the lovely *hetaira* Phryné sat as a model, was the most celebrated of all his marble works. The Cnidians refused to give up this statue even when Nikomédès offered to pay as its price the whole of their public debt, which was considerable. It was the pride of Cnidus, and was eventually destroyed at Constantinople, in the same fire which is assumed to have destroyed also the great Olympian Jupiter of Pheidias. The works of Praxitès, as noticed by ancient writers, are numerous, but the method and material are only occasionally indicated. The exquisite Faun in the Uffizi at Florence, the Aphroditè Kallipygè, and that of Capua so-called, both at Naples, are believed to be good copies of works by Praxitès.

PRAYER, a term in theology, used to designate the intercourse passing between the spirits of men and the omnipresent Spirit of God. Language is not necessary to complete the idea which the word represents, for prayer

may be thought directed towards God in adoration or in entreaty, without the sentiment of the mind being embodied in words or finding expression by the lips; but the more common use of the term is to express this kind of intercourse when the sentiment of the mind is embodied in language.

Considered historically, it may be said that the practice of prayer has ever been co-extensive with the idea of religion. Wherever men have believed in the existence of a spiritual power, or of spiritual powers, above them, they have assumed the possibility of entering into converse with them and have prayed. Whether tribes and races exist so degraded as to possess no idea of religion is a matter of dispute, but it is beyond question that prayer has been and is still used by men in every stage of social development from the lowest to the highest. Prayer forms an essential element in all the great religions of which we have any knowledge, and in some of the Oriental systems some very curious developments of doctrine in respect to it may be traced by the student of comparative theology. One of these developments has been noticed under OM, where an account is given of the praying "machinery" of the Buddhists. The duty of prayer is frequently enjoined in the Koran, and the Mohammedan doctors of divinity place it first among the duties of practical religion. In all Mohammedan countries public notice is given in the cities of the hours of prayer as they come round, and so fully is the obligation recognized that men kneel and pray in the street at the appointed hour as a matter of course, and without attracting notice. The first sura of the Koran is itself a prayer, and it is repeated by Mohammedans as frequently as the Lord's Prayer is used by Christians. The ancient Jews practised the duty of prayer both in connection with the worship of Jehovah, and of the other deities which from time to time received the national adoration. In the vivid description of the frantic devotion and frenzied prayers of the priests of Baal, given in 1 Kings xviii. 26-28, we have doubtless a presentation of a scene of common occurrence in the worship of that deity. At a later period, when the more spiritual teachings of the prophets had transformed the religious thought of the nation, the worship of Jehovah was conducted in a very elevated and beautiful manner. In the Book of Psalms we have illustrations of prayer in all its loftier forms, expressed in language of so much force and beauty, that after a lapse of some 2500 years the words still enter into the daily devotions of the most advanced and civilized races of the world. The duty of prayer was enforced by precept and example by the founder of Christianity, still further enjoined and illustrated by his apostles, and it has ever formed one of the most important elements of the Christian religion.

The doctrine of prayer, as developed by Christian theologians, assumes as its foundation the personality of God, his nearness to man, his willingness to hold communion with him, and his will to make the granting of some of his blessings conditional upon the performance of the duty of prayer. The essence of prayer is considered to be spiritual intercourse with God, and complete prayer is held to involve—(1) *adoration*, or the due apprehension of the divine character and of our relation to God as the All-Father; (2) *thanksgiving*, or an acknowledgment of our dependence, and of his goodness and providential care; (3) *contrition*, or the penitent acknowledgment of sin, imperfection, and unworthiness; (4) *petition*, which, includes the asking of general or particular blessings, suitable either to the general condition of the person praying, to the particular circumstances of the moment, or desired on behalf of others, prayer of the latter kind being termed *intercession*; (5) *submission*, the humble and complete recognition on the part of the worshipper that the divine will is the best, and that all petition must be made in the light of this truth and subject to its condition. Of course it is

not implied that these five elements must be *all* embodied in an act of devotion, for true prayer may be offered when only one of them is present, but they are all included in prayer when we use that term with a general application. Liturgies are of the nature of written collections of prayers, and in those in use in the Christian church of to-day are to be found prayers which, apart from those of the sacred writings, have been used continuously from the first centuries of Christianity. The Book of Common Prayer contains the liturgy of the English Church as appointed by authority. See LITURGY.

The doctrine of prayer presents certain difficulties when considered in relation to the divinely appointed order of the universe and the all-pervading providence of God, both of which conceptions are generally assumed as fundamental by theologians, and in recent times the efficacy of prayer has been the subject of considerable controversy. Passing over those who by the rejection of theism of necessity hold that prayer is useless, there are some who make a distinction unknown in earlier times, between prayer for physical or material blessings, and prayer as a mode of communion with God and a means of obtaining blessings of a spiritual character. Others go further still, and consider the only value of prayer to be its reflex action upon the mind of the worshipper. Comte, the founder of Positivism, among other transformations of Christian doctrines and practices, introduced a mental and emotional exercise to take the place of daily prayer, with the object of elevating and solemnizing the mind and enlarging its sympathies, but the practice has not been accepted as a necessary part of his system by the majority of his followers. Among Christians the majority still adhere to the practice of asking for whatsoever things they have need of from the heavenly Father, and most modern works on theology devote a portion of their space to the consideration of the objections noticed.

PREBEND (Lat. *prebenda*, from *præbeo*, a Low Latin word signifying provision or provender), the portion which the member of a cathedral or collegiate church, called a prebendary, received in right of his place for his maintenance. It was named from the place whence the profit proceeded, which was either from some temporal lands or church preferment attached to that church, or some other church whose revenues were appropriated towards the maintenance of the member of the cathedral or collegiate church. A prebendary differs from a canon in that he receives his prebend in consideration of services rendered in the cathedral, while the canon receives a stipend associated with his office merely in consideration of his having been received into the cathedral or college. Prebendaries, as such, have no care of souls, and therefore a prebend and a parochial benefice are not incompatible with each other.

PRE-CAMBRIAN or **ARCHÆAN ROCKS** are the deposits constituting the oldest recognized geological formation. The first name alludes to the fact that they are immediately antecedent in date to the CAMBRIAN SYSTEM, while the latter term has been proposed by Professor J. D. Dana in reference to their extreme antiquity. They have also received the names of *Azoic* (Gr. *a*, without; *zoe*, life) and *Hypozoic* (Gr. *hypo*, beneath; *zoe*, life), in consequence of the absence of undoubted organic remains, and their position beneath all fossiliferous strata; but this nomenclature is rarely now adopted.

If the well-known NEBULAR HYPOTHESIS of Laplace be accepted as affording a correct idea of the manner in which the globe originated, it is obvious that the sediments formed beneath the first expanses of water that existed upon the cooling surface must have been of a very different character to those produced at any subsequent date. The primitive crust would consist of a series of layers, of different density and composition, arranged in accordance

with chemical and physical laws; the more highly silicated rocks, for example, with alumina and the alkalis chiefly as bases, would constitute the lighter superficial zone, while rocks containing a less proportion of silica, and with the heavy oxides of iron, lime, and magnesia as bases, would occur as a zone beneath; and there is thus reason to expect that the earliest sediments formed from the detritus of these zones will exhibit signs of having been the result of chemical as well as mechanical agencies. Such, in fact, is actually found to be the case; and Pre-Cambrian rocks exhibit a remarkably similar mineralogical character in all parts of the world where they have been recognized. On the whole it appears that the circumstances that led to their formation were not mere local accidents, but were practically uniform over the entire surface of the globe, and there is thus so great a resemblance in the order of succession of these beds in all parts, that attempts have already been made to correlate them in widely separated areas on the evidence of mineralogical constitution alone.

Pre-Cambrian rocks are most extensively developed in North America, where they have long been studied in detail by the Canadian geologists. They were first brought prominently into notice in 1862, by Sir William E. Logan, who described the lower groups under the name of the Laurentian system, in reference to their typical development along the river St. Lawrence; and the subsequent researches of Dr. Sterry Hunt, Professor Dana, and Sir William Dawson, have resulted in the determination of six distinct series. Of these the lowest is the *Ottawa Group*, which consists of massive granitic gneisses, often mistaken for true granites; it corresponds to the Lower Laurentian formation of Logan. Next follows the *Grenville Series* (or Middle Laurentian of Logan), interesting on account of the great beds of limestone entering into its composition, and rendered noteworthy by the presence of the problematical structure known as coozon; beds of graphite and iron ore—suggestive of the agency of plant life—are also met with, and numerous quartzose gneisses, quartzites, and even pebble-beds occur in association with these. The Upper Laurentian of Logan is now more generally termed the *Norian Series*, and is especially remarkable from the predominance of granitoid rocks, chiefly composed of the well-known variety of felspar, LABRADORITE. This mineral was first discovered on the coast of Labrador, where the Norian rocks are extensively developed. The *Huronian Series*—so called from its occurrence on Lake Huron—succeeds the Norian, and consists chiefly of chloritic and hornblende slates, with interstratified conglomerates and crystalline limestones. Lastly follow the *Montalban* and *Taconic Groups*, which are still unfossiliferous, but which consist largely of rocks of a less metamorphic aspect than most of those preceding.

In Britain Pre-Cambrian rocks are most typically developed in the north west highlands of Scotland, where they were first detected by Sir Roderick Murchison. The so-called *Fundamental Gneiss* is the lowest group, and consists of massive rocks in which the prevailing minerals are red felspar, hornblende, and quartz; it is also known as the *Lewisian Series*, from its occurrence in the Island of Lewis. Immediately above this group there occurs a succession of thick schists, well-foliated gneisses, quartzites, and occasional beds of limestone; but these have not yet been very definitely subdivided into minor groups. Dr. Henry Hicks, however, is of opinion that there are representatives of the American Montalban and Grenville series, in addition to the Lewisian, which corresponds with the Ottawa group.

Less extensive areas of Pre-Cambrian formations have also been discovered in other parts of Britain, through the researches of Dr. Henry Hicks, Professors Hughes and Bonney, Dr. Callaway, and others; and at least three distinct divisions appear to have been already recognized:—

1. *Pebidian* (from *Pebidianæ*, St. David's), developed in North and South Wales, Shropshire, Leicestershire, and Ireland. This is the uppermost division.

2. *Arconian* (from the ancient name of *Carmarvon*), developed in Pembrokeshire, Carnarvonshire, Anglesey, the Huallt Mountains, and in Shropshire.

3. *Dimetian* (from *Dimetia*, the ancient name of a district near St. David's), the lowest division, developed in Pembrokeshire, Carnarvonshire, and Anglesey.

Of all the districts in question, that of St. David's, Pembrokeshire, has been submitted to the closest study, in consequence of its being the locality where these primitive rocks were first recognized in Wales. And it ought to be noted that so eminent an authority as Dr. Archibald Geikie has suggested that the deposits claimed to be Pre-Cambrian sediments and lava-flows, are really igneous rocks of intrusive character, bursting through the fossiliferous strata around. The other geologists already named, however, have shown that the lowermost beds of the Cambrian series contain waterworn pebbles of the rocks in question, and such is the case also in North Wales and Shropshire. The Dimetian group consists chiefly of massive granitoid rocks; the Arconian series is essentially of volcanic origin, comprising altered lavas and ashes; and the Pebidian group also affords traces of volcanic activity, but is mainly composed of ordinary sedimentary materials.

Pre-Cambrian rocks have also been recognized in most of the countries of the continent of Europe, and the order of succession is similar, on the whole, to that found in the British Isles.

(See Sterry Hunt's "Chemical and Geological Essays," and Dr. Hieks' "Presidential Address to the Geologists' Association," 1888, published in the *Proceedings*.)

PRECEDENCE (Lat. *precedo*, I go first), the relative social rank of men and women, determining the order in which subjects are introduced to their sovereign. In the United Kingdom there is no complete and comprehensive code for the definition and settling of social position, but there are several statutes regulating precedence, the first and most important being the Act 31 Henry VIII. c. 10, passed in 1539, entitled "An Act for the placing of the Lords in Parliament." Some of the provisions of this statute have been modified by the subsequent changes in the constitution of the kingdom, more especially by the union with Scotland in 1707, and the union with Ireland in 1800, but it still regulates the ranking of the kindred of the sovereign, the principal ministers of the crown and court, and both the spiritual and temporal members of the House of Lords. Where no Act of Parliament applies, precedence is determined either by the will and pleasure of the sovereign, or by what is accepted as ancient custom, questions of precedence being usually referred to the members of the College of Arms, who form the council of the Earl-marshal of England. The latter has charge of the arrangement of processions on state occasions in England, the Lyon Court being the authority for Scotland. The order generally recognized for the United Kingdom is as follows:—

TABLE OF PRECEDENCE AMONG MEN.

The Sovereign.	12. Lord President of the Privy Council.
The Prince of Wales.	13. Lord Keeper of Privy Seal.
Younger sons of the Sovereign.	14. Lord Great Chamberlain.
Grandsons of the Sovereign.	15. Lord High Constable.*
Brothers of the Sovereign.	16. Earl Marshal.*
Uncles of the Sovereign.	17. Lord High Admiral.*
Nephews of the Sovereign.	18. Lord Steward of the Household.*
Archbishop of Canterbury, primate of all England.	19. Lord Chamberlain of the Household.*
9. Lord High Chancellor.	
10. Archbishop of York, primate of England.	
11. Lord High Treasurer.	

* These take precedence only of all of their degree—dukes of dukes; marquises of marquises, &c.

20. Dukes of the blood-royal.	52. Judges of the High Court of Justice, in the order of their appointment.
21. Dukes.	53. Knights Bannerets made by the Sovereign in person.
22. Eldest sons of dukes of the blood-royal.	54. Viscounts' younger sons.
23. Marquises.	55. Barons' younger sons.
24. Dukes' eldest sons.	56. Baronets.
25. Earls.	57. Knights Bannerets not made by the Sovereign in person.
26. Younger sons of dukes of the blood-royal.	58. Knights of the first-class of the Bath, the Star of India, and St. Michael and St. George.
27. Marquises' eldest sons.	59. Knights of the second class of the Bath, the Star of India, and St. Michael and St. George.
28. Dukes' younger sons.	60. Knights Bachelors.
29. Viscounts.	61. Eldest sons of the younger sons of peers.
30. Earls' eldest sons.	62. Baronets' eldest sons.
31. Marquises' younger sons.	63. Eldest sons of Knights of the Garter.
32. Bishops of London, Durham, and Winchester.	64. Bannerets' eldest sons.
33. Bishops, according to date of consecration.	65. Knights' eldest sons.
34. Barons.	66. Baronets' younger sons.
35. Speaker of the House of Commons.	67. Knights' younger sons.
36. Commissioners of the Great Seal.	68. Companions of the Bath, the Star of India, St. Michael and St. George, and the Indian Empire.
37. Treasurer of the Household.	69. Esquires.
38. Comptroller of the Household.	70. Gentlemen, who by inheritance or royal grant are entitled to bear coat armour.
39. Master of the Horse.	71. Clergymen, barristers-at-law, officers in the army and navy.
40. Vice-Chamberlain of the Household.	72. Citizens.
41. Secretaries of State.	73. Burgesses.
42. Viscounts' eldest sons.	
43. Earls' younger sons.	
44. Barons' eldest sons.	
45. Knights of the Garter.	
46. Privy Councillors.	
47. Chancellor of Exchequer.	
48. Chancellor of the Duchy of Lancaster.	
49. Lord Chief-Justice of England.	
50. Master of the Rolls.	
51. Lords Justices of Appeal.	

TABLE OF PRECEDENCE AMONG WOMEN.

1. The Queen.	34. Wives of Knights of the Garter.
2. The Queen-Consort.	35. Wives of Knights Bannerets made by the Sovereign in person.
3. The Queen-Dowager.	36. Wives of the younger sons of viscounts.
4. The Princess of Wales.	37. Wives of the younger sons of barons.
5. Daughters of Sovereign.	38. Baronets' wives.
6. Wives of the Sovereign's younger sons.	39. Wives of Knights Bannerets not made by the Sovereign in person.
7. Grand-daughters of the Sovereign.	40. Wives of Knights Grand Crosses of the Bath, Grand Commanders of Star of India, and Grand Crosses of St. Michael and St. George.
8. Wives of the Sovereign's grandsons.	41. Wives of Knights Commanders of the Bath, the Star of India, and St. Michael and St. George.
9. Sisters of the Sovereign.	42. Knights Bachelors' wives.
10. Wives of the Sovereign's brothers.	43. Wives of the eldest sons of the younger sons of peers.
11. Aunts of the Sovereign.	44. Daughters of the younger sons of peers.
12. Wives of the Sovereign's uncles.	45. Wives of the eldest sons of baronets.
13. Nieces of the Sovereign.	46. Baronets' daughters.
14. Wives of the Sovereign's nephews.	47. Wives of the eldest sons of knights.
15. Duchesses.	48. Knights' daughters.
16. Marchionesses.	49. Wives of the younger sons of baronets.
17. Wives of the eldest sons of dukes.	50. Wives of the younger sons of knights.
18. Dukes' daughters.	51. Wives of Companions of the Bath, the Star of India, St. Michael and St. George, and the Indian Empire.
19. Countesses.	52. Wives of esquires.
20. Wives of the eldest sons of marquises.	53. Gentlewomen.
21. Marquises' daughters.	
22. Wives of the younger sons of dukes.	
23. Viscountesses.	
24. Wives of the eldest sons of earls.	
25. Earls' daughters.	
26. Wives of the younger sons of marquises.	
27. Baronesses.	
28. Wives of the eldest sons of viscounts.	
29. Viscounts' daughters.	
30. Wives of the younger sons of earls.	
31. Wives of the eldest sons of barons.	
32. Barons' daughters.	
33. Maids of Honour to Queen.	

A perusal of the foregoing tables, especially the first, will show that in many respects they are inadequate to meet the requirements of the present day. The political and social arrangements of the nation have undergone many changes since the original order of precedence was established, but these changes have received only slight recognition from the authorities whose decisions regulate its observance. Thus we find no precedence whatever afforded to the Prime Minister of the country, while the First Lord of the Admiralty, the Presidents of the Board of Trade and the Local Government Board, the Postmaster-general, the Vice president of the Council, and the law officers of the crown, are equally ignored. Further, it finds no place for the Lord-Lieutenant of Ireland, the Viceroy of India, or the Governor-general of Canada, while it awards high place to certain functionaries whose political importance is of the slightest kind. It is evident also that the nobility of the kingdom held a position of much greater power and influence in national affairs when this order of precedence was arranged than they do at present, or we should not find such officers as the Chancellor of the Exchequer, or the Lord Chief-justice of England, ranked after the younger sons of earls and the eldest sons of barons. A further defect may also be pointed out in the fact that in the scale of general precedence no place is found for clergymen except bishops, nor for lawyers except judges, while it makes only general mention of officers of the army and navy, from field-marshal to admirals of the fleet downwards. When we add, in conclusion, that certain grave questions of precedence concerning the great officers of state of Scotland and Ireland, and their position in reference to similar officers in England, though raised long ago, have never been definitely settled, it will be seen (revolutionary as such a suggestion must appear at first sight) that there is room for considerable enlargement and re-arrangement in the system of precedence as established in England.

PRECENTOR (Lat. *præ*, before, and *cantor*, a singer), in the Church of England, the official in a chapter, whether cathedral or collegiate, whose duty it is to conduct the singing. He ranks next in dignity to the provost or dean. In the Presbyterian churches he is the official who leads the psalmody, and is provided with a desk immediately beneath the minister.

PRECESSION, a term used in astronomy to denote a certain movement of the equinoctial points, which is readily disclosed by observation. Suppose that we determine the right ascension of a fixed star at widely separated intervals of time; for instance, let us take the mean right ascension of Sirius at the following dates:—

Date.	Hrs.	Min.	Sec.
January 1, 1847	6	38	25
" 1857	6	38	51
" 1867	6	39	17
" 1877	6	39	44
" 1887	6	40	10

We thus see that on the dates here chosen, which are separated by intervals of ten years, observations show that the mean right ascensions of Sirius have very perceptibly altered. It will also be noticed that the changes take place uniformly at about 2.65 seconds of time per annum. In the course of centuries this change becomes very marked, even to the coarsest methods of observing, and hence this phenomenon was discovered by Hipparchus about 2000 years ago.

From the results just given it appears that on 1st January, 1847, the vernal equinox crossed the meridian 6h. 38m. 25s. before Sirius. On 1st January, 1877, the vernal equinox crossed the meridian 6h. 39m. 44s. before Sirius. It is therefore obvious that in 1877 the vernal equinox and Sirius are further apart than they were thirty years previously. Compared with Sirius the vernal equinox

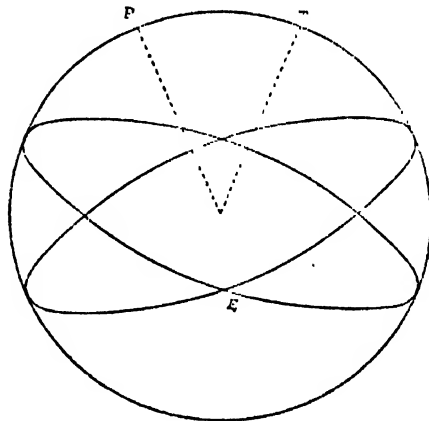
now arrives on the meridian earlier than it did thirty years ago. The phenomenon is thus appropriately known as the precession of the equinoxes. There is no special feature about Sirins involved in this statement; had any star been chosen we should have found that relatively to that star the vernal equinox was continually changing its position.

The equinox is defined as the intersection of the equator and the ecliptic. If, therefore, the equinox be moving, it follows that either the equator or the ecliptic, or both, must be in motion. The place of the ecliptic is determined by observations of the sun, and these observations show that the track of the sun among the stars is for all practical purposes invariable. We must therefore attribute the precession of the equinoxes to the movements of the equator. We can further analyse these movements so as to see what kind of displacement it is which the equator undergoes. Does the inclination between the two planes vary? This question is easily settled, for the obliquity of the ecliptic is the greatest declination of the sun on midsummer day, and it has been determined as follows in the years already referred to:—

Date.	Obliquity of Ecliptic.
January 1, 1847 ...	23° 27' 23.56"
" 1857 ...	23 27 37.12
" 1867 ...	23 27 13.85
" 1877 ...	23 27 26.51
" 1887 ...	23 27 14.22

It would not be correct to say that the obliquity was absolutely constant, yet the changes in its value are extremely small; in fact the greatest obliquity only differs from the mean by about one $\frac{1}{6000}$ part of the total amount. For our present purpose we may overlook these irregularities altogether; they arise from causes not now before us, and we can regard the obliquity as practically constant.

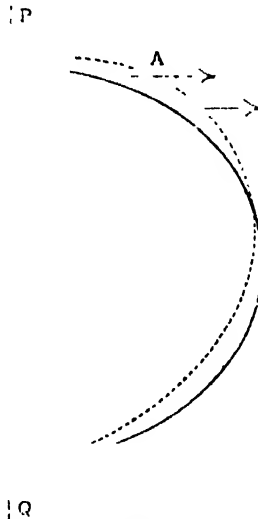
Seeing then that the ecliptic is at rest, and that the inclination thereto of the equator is to be constant, it follows that the change in the equinox can only arise from



the equator steadily moving round on the ecliptic while constantly maintaining the same inclination. Let r denote the pole of the equator, and τ that of the ecliptic, then since the ecliptic remains fixed among the stars, it follows that the place of r does not change. The angle between the planes is equal to the angle between the perpendiculars to those planes drawn through a point on the line of intersection. It is therefore evident that the obliquity of the ecliptic is equal to the angular distance of the poles r and τ . Hence, since we have seen that the obliquity of the ecliptic remains constant, it follows that the arc $r\tau$ remains constant, and therefore r can only move in a small

circle on the celestial sphere of which τ is the pole. By a comparison of ancient observations with modern observations it is found that the equinox ε moves through an angle of $50.26'$ annually. It will thus complete one revolution in 26,000 years, and consequently the pole of the equator, in virtue of the precession of the equinoxes, will sweep around τ at a distance of $23^\circ 27'$, and accomplish a complete revolution in 26,000 years. Such is the phenomenon known as the precession of the equinoxes, and some of its consequences are not a little remarkable. The Pole-star, so near now to the pole, was not always in this position. Thirteen thousand years ago the Pole-star was over 40 degrees from the pole, and in thirteen thousand years more it will again be separated by the same distance.

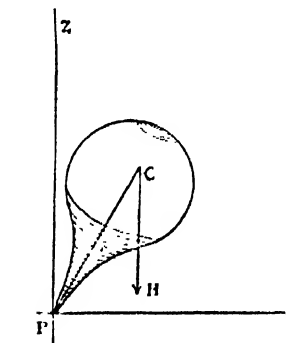
Let us now briefly describe the mechanical cause of this very remarkable movement. Suppose a body of the same shape as the earth be once set spinning around its polar axis $r q$, then it is obvious that the centrifugal forces



on the various parts of the body will neutralize, and that there will be no tendency for the axis to be displaced. Suppose now that from any cause the position of the earth be slightly deranged, as represented by the dotted line, then the centrifugal force, acting on the protuberant parts, will immediately tend to restore the body to its original position. If therefore the earth were unacted upon by any disturbing influence, the direction of its axis would remain constant, and the phenomenon of precession would not exist.

We thus infer that some source of disturbance must be present, and that that disturbance arises from the attraction of the sun and the moon on the protuberant regions at the earth's equator.

The exact explanation of the precession of the equinoxes is a matter of some complexity, but we can in a general way understand its origin by the illustration of a common peg top. Let $r c$, in the adjoining figure,



denote a peg top, rotating around an axis $r c$, then if the peg top were uninfluenced by any other force, the direction of this axis would remain constant. The disturbing

force in the present case arises from gravity, which, acting at the centre of gravity c , pulls the peg top downwards, along the line $c u$. It is a remarkable circumstance that the rapid rotation of the peg top causes the effect of this attraction to be quite different from what it would have been had the peg top been at rest. Instead of making the axis $r c$ fall down horizontally, it begins to describe a conical motion around the axis $r z$. In the rapid rotations of the peg top on its axis, and the slow rotation of that axis around $r z$, we have an illustration of the rotation of the earth on its axis, and of that slow conical motion of the earth's axis which constitutes the precession of the equinoxes.

PRÉCIEUSES, the nickname of certain literary coteries, composed largely of ladies, of which the chief was the Hôtel Rambouillet, in the middle of the seventeenth century. But while the blue-stockings of Madame de Rambouillet's clique were really learned, those of the imitative societies were only ridiculous. Molière satirized these ladies mercilessly in one of his first comedies, "Les Précieuses Ridicules" (1659), and also in "Les Femmes Savantes" (1672), one of his last.

PRECIPITATION occurs when a solid is thrown down from a liquid or a vapour in which it has been held in suspension or in solution, brought about by reagents, or by light or heat by a chemical recombination, or sometimes by a mere mechanical readjustment. It is to be distinguished from mere filtration or sedimentary deposit, though a deposit brought about by boiling off the water of a solution till it becomes supersaturated, and therefore parts with some of its contents (as in the case of kettles "furring"), is fairly to be called a precipitate.

Liquids are also precipitable from vapours which hold them in solution, the most familiar form of these being the Dew, Fog, Mist, Cloud, and Rain, together with the solids, HOARFROST, SNOW, HAIL, and ICE, which are among the forms of water precipitated, from various causes (usually arising from differences of temperature), from the atmosphere, which is charged with aqueous vapour. All of these precipitates are treated of in separate articles. This form of precipitation is usually called condensation, but without good reason, since it is not steam which is here condensed into water, but watery particles which are precipitated from suspension in air.

PRECOGNITION, in the law of Scotland, a preliminary examination of witnesses in reference to the commission of a criminal act, in order to ascertain whether there is sufficient cause for a trial, and to provide a case for the public prosecutor.

PREDESTINATION is a term used in theology to denote (1) an assumed decree or purpose of God, by which he has from all eternity predetermined whatsoever shall come to pass; (2) to the general purpose of redemption without regard to individuals; (3) to express the decree by which men are destined to eternal happiness or misery; and (4), in a restricted sense, to denote only election to eternal life.

Although the term belongs to Christian theology, the question to which it finds an answer has been asked in connection with most of the great systems of religion, and it occupies also an important place in many systems of philosophy. The question is, in its widest sense, to what are we to ascribe the origin of good and evil? and the answer given by the doctrine of predestination, pushed to its logical conclusion, is, that the origin of both must be found in the will of God. Among the Jews the Pharisees and Essenes are said by Josephus to have held doctrines which exalted the divine preordination of events to an extent which destroyed human freedom and volition, while the Sadducees, on the other hand, insisted very strongly on the freedom of the will, and went so far as to deny predestination altogether. As the questions concerning the

origin of evil and its consequences naturally arise in connection with every known form of monotheism, it is not to be wondered at that questions as to predestination began to be argued during the first centuries of Christian history, or that as Christian doctrine became defined and formulated certain theories should be propounded and defended by the theologians. Justin Martyr (A.D. 150) and Tertullian (160-220) both deal with the subject in their writings, but it was left for Augustine in his conflict with Pelagius to formulate a complete and consistent theory, based upon the sovereignty of God, according to which the destiny of every man was preappointed from all eternity, some being ordained to endless life, while others were left to sin and endless misery. The controversy between the followers of Augustine and Pelagius was continued at a later period by the schoolmen, the Augustinian theory being supported by the Thomists, while the Scotists for the most part adhered to Semipelagianism. At the Reformation the discussion was renewed among the Protestant divines, the doctrines of Augustine being set forth with the utmost force and the most relentless logic by Calvin, while an opposing theory was propounded by Arminius, each theologian giving his name to the system he formulated. In the Roman Catholic Church the controversy was continued by the Jansenists and Jesuits, and after the Gallican Church had been almost torn asunder, the decision of the papacy, supported vigorously by the civil power, gave the victory to the latter.

The doctrine of predestination is still accepted by some important sections of the church, but most of its supporters endeavour to evade its harsher features; and whatever may be required by rigorous logic no modern theologian would enforce all the conclusions or adopt the illustrations of Augustine or Calvin. There is, moreover, at the present day, a growing disposition to avoid controversy upon the subject, and to relegate many of the points in the dispute to that region of the unknowable to which of necessity they belong.

For an account of the leading controversialists in connection with this doctrine, see under AUGUSTINE, ARMINIUS, CALVIN, and an account of some of the more important controversies will be found under CALVINISM and JANSENISM. See also FREEDOM OF THE WILL.

PREDICABLES. The term predicable (Gr. *kategorikon*, Lat. *predicabile*) is applied in logic to general names considered as capable of being the predicates of propositions. The classes of predicables usually recognized by logicians are five, viz.—1, Genus; 2, Species; 3, Differentia; 4, Proprium; 5, Accidens; which Latin names are translated from the Greek, (1) *genos*, (2) *eidos*, (3) *diaphora*, (4) *idion*, (5) *sumbebēkos*.

The fivefold classification of the predicables does not occur in Aristotle's "Organon," or any other of his extant writings, and it probably did not occur in any of his lost writings. The word *genos* is often used by Aristotle to signify a class; there is, however, no instance of the use of the word *eidos* in the sense of a logical species in his writings.

The earliest work in which the received classification of the predicable occurs is an "Introduction to Aristotle's Categories," written by Porphyrios of Tyre. From this treatise the classification and explanation of the predicables have passed into the various treatises of the Aristotelian logic, and have been repeated, with some variations, to the present day.

PRE-EXISTENCE, DOCTRINE OF. The belief that human souls have had an existence previous to the birth of the body, as well as that their existence will continue after death, has, from a very early period, been widely accepted throughout the East, and it is assumed as a fundamental truth by the theologians of Brahmanism and Buddhism. It was also accepted by many of the philoso-

phers of ancient Greece, and it found a place in the wide and lofty speculations of Plato. The latter, whose ideal of the soul was of a very elevated character, appears to account for what he considers to be its humiliating relation to the body by the theory of its previous existence in a higher state of being, from which it has fallen into the sphere of sense and under the conditions of time. This theory naturally found a place among the speculations of Neo-platonism, from whence it passed into the Christian church. It received the support of Origen, who went so far as to assert that the souls of men have a separate conscious existence in a previous state, and though the majority of Christian theologians opposed the theory, it was supported by several teachers, who, with their followers, were termed Pre-existenceists. The other theories which obtained favour among the fathers were those of, (1) Creationism and (2) of TRADUCIANISM. According to the Creationist theory each soul is the immediate work of the Creator, who is perpetually creating souls and infusing them into bodies, while Traducianism regards the soul as the highest part of the inheritance of life received by each human being from his parents. Of these opposing theories, that of pre-existence was, at an early period, branded as heresy, and Creationism became the accepted orthodox doctrine of both the Eastern and Western churches. Traducianism, however, has received the support of some eminent theologians and teachers, from Tertullian down to Delitzsch and Klee, and the theory of pre-existence itself has been revived and defended by some of the modern theological writers of Germany. As a speculation, the theory of pre-existence has been entertained by many individual thinkers. It finds a beautiful expression in the celebrated ode of Wordsworth's entitled "Intimations of Immortality from Recollections of Early Childhood"—

"Our birth is but a sleep and a forgetting;
The soul that rises with us, our life's star,
Hath had elsewhere its setting,
And cometh from afar.
Not in entire forgetfulness,
And not in utter nakedness,
But trailing clouds of glory do we come
From God, who is our home.
Heaven lies about us in our infancy.
Shades of the prison house begin to close
Upon the growing boy,
But he beholds the light, and whence it flows;
He sees it in his joy.
The youth, who daily further from the East
Must travel, still is Nature's priest,
And by the vision splendid
Is on his way attended.
At length the man perceives it die away,
And fade into the light of common day."

PREFERENCE SHARES. Preference bonds and shares are means adopted for attracting capital to a trading company, either upon an emergency or as part of the regular system of issue. By the issue of this form of stock the ordinary bondholders or shareholders are set aside until the preference bondholders or shareholders have received the sum agreed upon, which is therefore a first charge upon the company's receipts. Either it is a fixed rate of interest, or it is a preferential claim to profits up to a certain point, as may be decided. Sometimes more money still is wanted, and *second preference bonds* (or shares) are issued, followed by *third preference bonds* (or shares) on rare occasions, whose preferential claims rank in the order of their issue. A desperate expedient is sometimes resorted to under great pressure by the issue of *preference bonds* (or shares), which set aside the preferential claims of the preference bonds, just as these set aside those of the ordinary shares, until their own are satisfied. Of course this can only be done by consent of the original preference creditors.

In connection with the railway capital of Great Britain the highest rank in point of security is taken by the de-

lature and guaranteed stocks, after which come the preference, and then the ordinary stocks. In the United States the bonded debt of the various companies stands first, and as this is often the most important item, the "preference" shares are often of very questionable value in spite of their priority over the ordinary shares.

PREGLACIAL DEPOSITS, in geology, are the comparatively superficial accumulations of sediment formed during the early part of the Pleistocene period, before the refrigeration of the glacial epoch in Northern Europe became intense. See GEOLOGY.

PREHISTORIC PERIOD, in geology, is defined by Professor Boyd Dawkins (in his "Early Man in Britain") as the short epoch between the Pleistocene and the dawn of history, characterized by the presence of man in a higher stage of civilization than that of a nomad hunter. At this time Britain had become finally isolated from the Continent, and the Irish elk (*Cervus giganteus*) appears to be the only European animal of the period that has since become extinct. See GEOLOGY.

PRELATE (etymologically from Lat. *præ* and *latus*), a person *preferred* or advanced before another, but it is confined to a particular species of preferment or advancement, namely, that among the clergy; and it is applied to those only among them who have attained the very highest dignity, that of bishop or archbishop, to which we may add *patriarch*, in such churches as have an officer so denominated. The word prelate has, however, in ancient times been applied to simple priests, members of the clerical body in general.

PREMIUM (Lat., a reward), a money consideration given for a certain purpose, the chief uses being the following:—*Premium on gold* (or silver), almost identical with the term *agio*. When 100 dollars in gold would buy 125 dollars in greenbacks, gold was said to be at a premium (or *agio*) of 25 in America.

Premium of insurance, the small price paid to cover a large risk in marine insurance, or the yearly sum paid to cover risk of fire in fire insurance, or the yearly sum paid to insure a stipulated amount at death or at a certain period in life insurance.

Premium on stocks and shares. When such obligations are salable at a price higher than their issue value they are said to be at a premium, as when £100 English consols fetches £101 (consols at £1 premium); or when £100 nominal Russian stock fetches £95 10s., having been issued at £94 (Russians at £1 premium), &c.

PREMONSTRATEN'SIAN or **NORBERTINE ORDER**, a religious order founded in the early part of the twelfth century by St. Norbert, a native of Xanten in the diocese of Cleves, of which church he was canon. He was a man of sincere piety and great austerity of life, and his aim in founding his order was to restore the primitive simplicity and earnestness to monastic and conventual life. His rule was that of the Canons Regular of St. Augustine, with some slight alterations and the addition of certain severe laws. His first cloister was founded about 1120 at Premonstratun, in the diocese of Laon in Picardy, this name being given to the place on account of a supposed vision of the blessed Virgin. As with many other religious orders the first years of these monks were their best, from a religious point of view, and they appear for a generation or two to have exerted a very beneficent influence in France and Germany by the sobriety of their lives and their useful labours among the people. In the course of time, however, the order became wealthy and powerful, and the usual consequences of avarice, pride, luxury, and vice, attended the change, until about the close of the sixteenth century, when much of its popularity had been lost, it underwent an important internal reformation. The first monks earned their livelihood by cutting fagots in the woods, and selling them for fuel, their only

property being their tools and an ass to carry the wood; but thirty years after their foundation they had 100 abbeys in France and Germany. They never made much progress in Spain or Italy, but they were brought into England shortly after the year 1140, and settled first at Newhouse in Lincolnshire. They had in England a conservator of their privileges, but were nevertheless often visited by their superiors of Premonstratun, who raised great contributions out of them, till restrained from it by the Parliament of Carlisle, in the last year of Edward I., 1307. During the period of their greatest prosperity they are said to have possessed 1500 convents for men and 500 nunneries for women, nearly all in France, Germany, and the northern kingdoms. Tanner reckons about thirty-five houses of this order in England, and they had six in Scotland, as well as several in Ireland. In England the members of the order were known as the *White Canons*, from their habit, which was a white cassock with a rochet over it, a long white cloak, and white cap. The order was declining in France during the period previous to the Revolution, and since that event it has disappeared from that country. It has a few houses still in Austria, but it enjoys only a shadow of its former prosperity.

PREPOSITIONS are certain words which express a relation between different things. Prepositions are so called because they are *preposed* or prefixed to the words with which they are connected; but the name is an unfortunate one, since they are sometimes *postponed* or placed *after* such words, as in *wherewith*, *wherein*, *whence*, *whereto*, *thereby*, &c. In languages like our own, which have hardly any inflexions, the relation which one thing bears to another can only be expressed by means of prepositions; but in languages which possess inflexions, like the Latin and Greek, the same relation may frequently be expressed by means of cases. Prepositions, historically, were originally adverbial prefixes to the verb, serving to point out more clearly the direction of the verbal action; their next development was to detach themselves from the verb and attach themselves at the beginning of the noun, thus assisting the latter to disencumber itself of its case-endings (as in our own and all late tongues), and assuming the function of these last. The oldest prepositions are from pronominal roots, the next oldest from verbal. In English we have lost case-endings almost entirely. Thus, in the expression "the son of the king," we express the relation between "son" and "king" by the preposition "of;" while in Latin the same relation is expressed by *is* placed after the Latin word for king, *filius regis*. But as the meaning of these case-endings was not always definite enough, prepositions were still used in order to mark the relation more precisely; so that in such expressions as *ad urbem*, *cum reg-e*, *pro reg-e*, the noun may be said to have two words to mark relation, one placed before and the other after it. This use of prepositions governing cases, as we say, is strictly followed in the oldest forms of English (450 up to about 1100 A.D.), and with less strictness for some centuries later, while case-endings still continued.

The number of prepositions differs, as might be expected, in different languages. The Greek grammarians admit only eighteen, the Latin about fifty.

English prepositions may be divided into simple and compound. The chief simple prepositions are the following:—

In, from a pronominal stem *a + na*; formerly with a tendency to lose the *n* before a dental, as "i the bud." *At*, originally *æt*, equivalent to Latin *ad*, Sanskrit *adhi*. *Of*, Latin *ab*, Sanskrit *apa*; not to be confounded with the Frenchified use of the same word as equivalent to the French *de*: for instance, the Old English *of* is seen in "When thou art bidden of any man to a wedding" (Luke xiv. 8), and is distinct from "the quality of mercy," &c. *By* is properly a suffix; compare Sanskrit *abhi*, Greek

-phi, &c. *For*, from, the latter with a superlative *m* as a suffix. *On*, originally *an*. *Up*, from a stem *u* + *pa*, the Greek *apo*, Latin *s-ab*, German *auf*. *Out*, originally *ut*, still to be seen in "utter," "utmost." *With*, the Old English *with* or *with*er, then having the sense of against, as "There wrestled a man *with* him" (Gen. xxxii. 24); our modern *with* represents the German *mit*, *u* replacing *m*, as "Geh' *mit* ihm," "Go *with* him." *To*, formerly often equivalent to *for*, as "I take *to* wife;" with another form, *too*.

Compound prepositions are sometimes comparative forms; as *after* (comparative of *of*); *over* (comparative of *up*); *under* (in with comparative suffix *-ther*); *through* or *thorough* (from root *tar*, to go beyond). Another class is made of combinations of simple prepositions, as *into*, *upon*, *beneath*, *without*, &c.; less clear, but still of this class, are *but* (by-out), *above* (up-over), *about* (a-by-out), *unto* (un-till), &c. Prepositions may also be made of substantives, as *instead of*, *for* the sake of, &c.; *abroad*, *abreast*, *atop*, *across*, *beside*, &c.: or of adjectives, as *till* (the Old English word meaning "good"), *toward* or *towards*, *along*, *amid* or *amidst*, *below*, *since*, i.e. *sithance* (from *sith*, late). Participial constructions give us *notwithstanding*, *owing to*, &c.

Many prepositions are adopted into English from the Latin and its derivative Romance tongues—simply, as *per*, *sans*, &c.; or compounded, as *because*, *by virtue of*, *in spite of*, *with reference to*, &c.; *agreeably to*, *exclusive of*, *around*, &c.; or of verbal origin, as *during*, *according to*, *excepting*, *respecting*, &c.; and a few passive verbal forms, as *excepted*, *past*, *sare*.

Prepositions may also be divided by their meaning into relations of place, time, causality, &c., and these into subdivisions.

PRE-RAPHAELITE BROTHERHOOD, THE, contracted into the mystic initials P.R.B., a society extremely limited in numbers, but unlimited in influence, which, although failing in its immediate objects, yet like the alchemists of old, has done great and lasting work. About the middle of this century (1849-50) some very distinguished young painters, disgusted with the conventions of the art of the day, full of hollow trick and bald imitation of the great Italian or Flemish painters, devoid of moral meaning, and with not much more originality than a pattern of wall-paper, resolved to change it if they might. No man dared at that date to paint a landscape without a "brown tree," or a figure piece direct and unaltered from actual living models, under pain of artistic ostracism. Tracing back the falsity thus introduced into art, these young men found it, or thought they found it, to originate from the great Raphael himself. His consummate skill undoubtedly led him to invent and idealize rather than paint from nature, and what was inspiration in him became a soul-stifling law to his successors and blind imitators. Before Raphael (or Raphael as the name was then written) men were of sterner stuff, painting absolutely what they saw, without conventionality, each man doing his best on his own lines. William Holman Hunt, John Everett Millais, and Dante Gabriel Rossetti were the three chief members, the latter as exquisite a poet as a painter; and the other members were the sculptor Woolner, the critic and painter Stevens, and the critic William Rossetti, brother of the artist-poet. All these men rose to the very highest distinction, and several of them became members of the Royal Academy. Only Hunt and Rossetti, however, remained faithful to the method with which they started, and even they were found to yield greatly as time went on; the others wisely retained their true principles, but profited by the improvements in method which the ages had accumulated.

The aims of the Pre-Raphaelite Brothers were to revolutionize art, and especially painting, by insisting on a

direct moral purpose, a meaning in each work, coupled with absolute fidelity in every detail. If a tree were painted, the leaves were to be shown just as one sees them; if woven texture were introduced the threads must be there if the eye could see them on the model; colours must not be falsified or toned down to get aerial perspective, nor introduced to give "balance" if not really present, &c. These and many other of the "illusive" artistic sins they pledged themselves to avoid; their works were to bear the monogram P.R.B.; their gospel was to be preached in a journal, *The Germ*. The natural result followed. This fiery defiant enthusiasm developed extravagance. Millais produced a well-known "Jesus in the House of his Parents" which was at once nicknamed the "Carpenter's Shop," because the conventional "reverent" attitude was contemptuously cast aside. Jesus was at work helping his father in his trade, a simple boy, in no way idealized, and not particularly charming. The Virgin was rather ugly, wrinkled, and careworn; the remaining figures were equally faithful to actual life, and equally regardless of grace or beauty. The same occurred with all the other members. In the eagerness to tell truth and not agreeable lies, the brotherhood, one and all, accepted stiffness and ugliness joyfully. Still the originality and the absolute faithfulness of their work told with increasing weight. It attracted the notice of the famous critic John Ruskin; and immediately the magic of his pen was exerted in favour of the new principles, artists rallied to the standard, and a considerable section of art-loving society became interested, half converted. The almost unrivalled prose of the great writer finally gained the victory for the Pre-Raphaelites, so far as it was gainable. They on their side abandoned their defiant attitude, chose charming models instead of plain ones, and the like; in short they left off extravagance while retaining originality, and the result was a new life breathed into English art, the pulses of which still throb with the vigour due to the high aims of the Pre-Raphaelite Brotherhood.

PREROGATIVE, that power of the crown, according to the judicious definition of Hallam, which used to give it "an advantage over the subjects in cases where their interests come into competition, by reason of its greater strength." This kind of prerogative is almost obsolete now in England, and what still remains to the crown in the shape of prerogative is a certain initiative in many important matters on the part of the nation, and a right of decision on a few but weighty points without needing to consult Parliament. The articles KING and CROWN may be referred to on the general history of the royal office and power.

The history of prerogative in England, up till almost our own century, is "one long story of assumption and evasion" (Stubbs). Our native kings of England, before the Conquest, had a personal, not a territorial, authority; the Witan really legislated; the royal prerogatives were few, and rather in the nature of special privileges than prerogative proper as we know it later. They received wergild and the royal revenue, exercised the right of purveyance, superintended jurisdiction in every way, had the power of pardon, &c.

The Norman kings carefully avoided defining prerogative, and on all occasions, and they were not few, assumed a right as opportunity offered. They were most capable men, especially William the Conqueror and Henry I. Their rights as victors gave them colossal wealth, and consequently enabled them to maintain and reward a resistless force, especially when, as was usually the case, the people at large supported the more merciful rule of the crown against the petty tyrannies of the baronage. The Normans recognized no limit to their authority. They had overthrown the English polity, and no custom had yet had time to grow up and replace it. They taxed where and

how they pleased, consulting or not consulting the council as they chose. They sternly supported justice and put down lawlessness, and their strong hand was not ill liked by the people, for it was used for what all men held to be worthy purposes. One check alone operated. The succession was distinctly elective. The very first successor to the Conqueror was a second son, to the prejudice of his elder brother; consequently it was necessary now and then to conciliate the people by the issue of charters of liberties.

The Angevin kings (Plantagenets as they used to be called) committed the same error as successors of the Normans which the Stuarts committed as successors of the Tudors. They found a strong royal prerogative, due to a real kingly and not altogether unpopular authority, but which the people were beginning to find irksome: they tried to strain the cord still tighter, and it broke in their hands. The very son of that Henry II. who had succeeded, by force of mind and craft of policy, in gaining absolute supremacy over the legislature, and only failed by an accident from gaining an equal supremacy over the church, had to sign away in Magna Carta all those assumed prerogatives which were due to Norman and Angevin alike, and return practically to the English limited monarchy. Now followed all through the Angevin period down to the time of the Edwards the long struggle over the Charter, perpetually broken, and as often confirmed. [See MAGNA CARTA.] Many circumstances combined to tame the Parliament of the last of the Plantagenets, and Richard II. received a declaration from the national assembly in 1391, that "the royalty and prerogative of his crown should ever remain intact and inviolable." Haxey attempted to pass a bill to control the royal extravagance in 1397: he was tried for the offence and found guilty of treason. Richard declared that "his laws were in his own mouth, and often in his own breast, and that he alone could change and frame the laws of the kingdom." This attempt to return to Norman despotism produced its natural effect after the first years of success had passed by. Richard was deposed in 1399 on thirty-three charges of injustice, extortion, and general misgovernment, and one of the charges was that given above.

The Lancastrian kings who succeeded owed their title to Parliament; and the new dynasty began with a very serious limitation of prerogative. Parliamentary consent to taxation, so often neglected by Richard II., was now made a necessity, and the idea of ministerial responsibility began to appear. Little by little the right of inquiry into abuses was established in Parliament, the royal administration was not only criticised, but controlled; and finally, in 1408, a firm attack was made on the prerogative by a petition of thirty-one articles demanding the removal of certain evil counsellors, the proper settlement of the royal debts, the regulation of purveyance and of other abuses, &c. Writers of the time describe the happy political condition of England, where "the king exists for the kingdom, not the kingdom for the king" (Sir John Fortescue).

The Yorkist kings, however, came into power through a most bloodstained civil war, leaving the barons almost crushed, and the people exhausted and only too ready to support a strong rule insuring quiet to a troubled land. Consequently prerogative grew; and we find all the parliamentary safeguards set at naught, the royal power almost unchecked, and even a new departure, the frequent use of the SUSPENDING and the DISPENSING POWER hitherto only sparingly applied, and the levying of uncontrolled and illegal taxation under the new name of BENEVOLENCES.

The Tudors were among our most capable sovereigns, and extended the prerogative considerably, not so much by arbitrary assumption as by obtaining recognition of the alleged powers from Parliament. The Court of the Star Chamber and the Court of High Commission were appar-

ently legal courts. Henry VII. amassed an immense hoard, but far more by excessive fines for various offences, applied under cover of the authority of Parliament, than by the illegal benevolences to which he also occasionally resorted. Henry VIII. carried the system still further. It was the Parliament which decreed him supreme head of the church, and enabled him to fill his coffers and enrich his followers with the spoil of the monasteries. It was the Parliament which gave him the right to alter the succession and gave his proclamation the force of law, thereby marking the highest point ever touched, legally, by the royal prerogative in England. But, as Bolingbroke acutely remarks, Henry admitted by these skilful applications to Parliament that prerogative depended on its consent. Mary used fully the great powers her father had thus gained for the crown, governing by proclamation and taxing by forced loans. Elizabeth went further: she ruined the independence of Parliament by swamping it through the creation of sixty-two rotten boroughs, and then denied its independence, declaring she would not have "her prerogative argued nor brought in question." But, great ruler as she was, the day of absolute rule was over. She was as astute as she was great, and her gracious yielding directly she felt the symptoms of a coming resistance on any point kept the affection of her people close to her to the last. Elizabeth's management of her Parliaments amounts to a fine coquetry, and exhibits her at her cleverest.

The Stuarts, feeble, selfish, unpatriotic, thought to do what the vigorous, noble, patriotic queen had wisely seen she must yield. James I. added to the Tudor prerogative the assertion of the "divine right of kings" and the doctrine of "passive obedience" as a duty. From these followed absolute supremacy, inviolability, and the regardance of popular liberties as concessions due to the grace or to the weakness of preceding sovereigns, and revocable therefore at pleasure. The doctrine of passive obedience was directly inculcated in the "Canons" of 1604, and so strongly advocated as to call down the censure of Parliament in 1610, and an insistance upon the suppression of the book. In 1628 the Parliament, now awake to its danger, impeached Dr. Mainwaring for preaching in favour of absolute monarchy, found him guilty, and condemned him to a heavy fine. Charles I. paid the fine, and at once appointed the preacher Bishop of St. David's. The result of such doctrines really attempted to be put in practice was the overthrow of the monarchy altogether. After the Restoration some feeble attempts were made to revive "divine right," as by Filmer in his "Patriarcha" (written in 1653, published in 1680), a treatise which must be regarded with thankfulness, since it called out the masterly reply of Locke's two treatises on "Civil Government" (published 1690). Locke's and Filmer's treatises form one volume of Morley's Universal Library (1884), and can thus be purchased for a shilling. The earlier Stuarts also attempted to interfere with justice, both by the perfectly illegal Court of Star Chamber, and also by pressure on the judges of the royal courts. The latter were brought into complete subservience, as the well-known cases of Bates and of Shipmoney show. And when in 1616 the judges refused to delay the administration of justice in the famous case of COMMENDAMS, James sent for them and made them ask pardon on their knees. Coke, who refused, was dismissed from the chief-justiceship. Thenceforth for a few years justice became a farce; and the king informed Parliament that it was "sedition to inquire what a king could do by virtue of his prerogative." Hence all kinds of arbitrary taxation and abuse grew rife. In 1628 Charles I. had to assent to the PETITION OF RIGHT, but at once sought to evade it in his attempt to rule England (from 1629 to 1640) without a Parliament, levying TONNAGE AND POUNDAGE, selling monopolies, reviving the forest laws, exacting ship-money, distraint of knighthood, and the like.

Then came the era of the Long Parliament, and many of these abuses vanished for ever, the hated Star Chamber among them. The feudal exactions, many of which still remained, were bought of the crown at the Restoration (1660) for a fixed annual revenue. Charles II. knew too well to try hard the temper of the people whose wrath cost his father his head, but he, too, made a little money by the use of his prerogative, confiscating city charters right and left, and restoring them only for due consideration, either of money or influence. But James II. was less wise than his brother. All that had not been formally annulled he at once set into force; and he even went so far as to levy customs by proclamation in 1685 before they had been granted by Parliament, and to procure a judicial decision in favour of the DISPENSING POWER. The best comment on his success is that he only reigned three years, and then fled into perpetual exile.

This was the end of the indefinite royal prerogative. The BILL OF RIGHTS set due limit to it. The suspending and dispensing power was taken from the royal hand and made subject to parliamentary control, every pretext of levying money was withdrawn from the crown, even the power to maintain a standing army was taken away, and the privileges of Parliament were firmly upheld. Again, in 1701, when the Act of Settlement provided for a new dynasty, these and further checks on the prerogative were made sure. By the Act of Settlement the crown was prevented from its favourite trick of swamping the House of Commons with placemen, the royal pardon was refused in cases of impeachment, and the judges were declared irremovable except upon the addresses of both houses of Parliament.

The house of Brunswick has accepted the constitutional position. Once, indeed, George III. tried to increase the prerogative. He created by lavish bribery and all kinds of backstairs influence a "king's party," and attempted to be his own minister, acting through North as his mouth-piece. This drew down upon him, in 1780, the thunderbolt which has immortalized the name of Mr. Dunning; for this member induced the House to pass the famous resolution that the royal influence "had increased, was increasing, and ought to be diminished."

The present prerogative of the crown is perhaps the least part of its influence. The love of the sovereign, the exalted position of royalty, its acknowledged leadership of society, and its influence by patronage confer greater power upon the king than his legal rights. These latter tend to become nominal, since the king acts through his ministers, and they, not he, are responsible to Parliament. Of this kind are the prerogative of summoning, proroguing, and dissolving Parliament, of vetoing a bill (practically obsolete), of making peace or war and signing treaties, of sending and receiving ambassadors, of pardoning convicts, of creating peers, and of (practically) appointing bishops. The choice of ministers, though it is usually clearly indicated by the popular voice, does really rest to a small extent with the crown. It is not of a dangerous nature, because if the monarch sends for advisers who have not the popular ear, they either request to be excused, or if they accept office they find themselves without any substantial colleagues. The position has always proved so undignified for the crown that it is not likely often to occur. Even if a ministry could be patched up, it is contemptuously dismissed by the House of Commons on its first appearance, and passes away "a transient and embarrassed phantom."

Though the sovereign has no longer even the smaller fiscal prerogatives of purveyance, coinage, markets, tolls, &c., but is entirely dependent on the House of Commons for money, he is of himself and with his ministers still the head of the church, the army, the navy, the law, the fountain of justice, mercy, and honour; and has the supreme executive power. In legislation he has (that is,

his ministers have) the chief initiative, and is of equal power in theory with the Houses of Lords and Commons.

PREROGATIVE COURT, the court in England held by the Archbishops of Canterbury and York, in which formerly all wills were proved and administrations taken out. They were deprived of these functions in 1858, when a new court, entitled the Probate Court, was established for the transaction of this business. The Probate Court now forms one of the divisions of the High Court of Justice, established by the Judicature Act of 1873.

PRES'BURG or **PRESSBURG** (*Pozonium*; in Hungarian, *Pozony*), once the capital of Hungary, is situated on the north bank of the Danube, and on the Pesth Railway, 41 miles E. from Vienna, and has 50,000 inhabitants. More than one-half the population are Germans, and German is the prevailing language. About two-thirds are Roman Catholics. The town, which is surrounded by vineyards, is built on a hill of moderate height, commanding a fine view over an extensive plain watered by the Danube, which is here crossed by a bridge of boats. The fortifications have been demolished, and the suburbs are no longer separated from the city. The town seems to have existed in the time of the Romans. In 1446, Ofen having fallen into the hands of the Turks, Presburg was declared the capital of Hungary, and the diets were held there. In 1784 Joseph II. decided that the vicerey and palatine, with the high officers of government, should reside at Ofen, as a more central situation. The emperor is, however, still crowned here as king of Hungary. Presburg, which was formerly not only the handsomest, but the most important and most populous city in Hungary, is now far surpassed in all respects by Pesth and Ofen. The city has a large transit trade in corn, linen, and Hungarian wines, in consequence of its vicinity to Vienna and of the navigation of the Danube by steamers. The principal buildings are—the hall of the Diet, the Gothic cathedral, in which the kings of Hungary were crowned; the churches of Capuchin, Franciscan, and Ursuline monasteries; the county hall, the ancient senate-house, the archiepiscopal palace, and the theatre. Among the public institutions are several academies, a royal model school, a library of 50,000 volumes, the gift of Count Appony to the town, and several hospitals, one entirely supported by the Jews, who are numerous here, and have many charitable institutions. On a hill out of the city, 439 feet above the level of the Danube, are the remains of the royal palace, which was burnt by the French in 1811, and has not been restored. It was in this palace that the Hungarians in 1741 uttered the famous outburst of loyalty towards their *King*, Maria Theresa, *Moriamur pro nostro rege* (We will die for our king). There are various manufactures of woollens, silk, tobacco, snuff, nitre, oil, rosoglio, and leather. A treaty was signed at Presburg in 1805, after the battle of Ansterlitz, by which Venice was ceded to Italy.

PRESBYO'PIA is a term used to designate that condition of vision in which the eye can see distant objects very well, but those which are near very badly, and which is more commonly known as long-sightedness. It generally occurs about middle life, and tends to increase with age, owing to the flattening of the lens preventing a proper conveyance of light upon the retina. It is corrected by the use of convex glasses, which must be ground according to the degree to which the eyes are affected. The opposite condition of vision is termed *Myopia* or short-sightedness.

PRESBYTERIANISM (Gr. *presbyteros*, elder), the name given to a system of doctrine and church government which arose at the period of the Reformation, the supporters of which believe that there is no order in the church, as established by Christ and his apostles, superior to that of Presbyters; that all ministers are of equal authority; that presbyter, or elder, and bishop are only different names for the same person; and that deacons are

laymen whose office is chiefly to take care of the poor. Although Presbyterianism, as a system, arose during the Reformation period, its adherents claim that its introduction was but the return, after a long period of error, to the primitive constitution of the church. The protracted controversy which has been waged between the advocates of Presbyterianism on the one hand and the defenders of Episcopacy on the other, has been noticed under Bismarck, and it only needs to be noticed here that, however the doctrinal dispute may be decided, Presbyterianism has proved in practice to be a very efficient system of church government. In all existing Presbyterian churches the organization differs from Episcopacy by the institution of elders elected to represent the congregations, of which the minister or preaching elder is one, and by its placing all its church rulers on the same footing of rank or dignity; while at the same time it differs from Congregationalism, in which each church is independent of the rest, by carrying out to their widest limits the principles of union, subordination, and centralization. Thus the affairs of particular congregations are managed by a court, styled in Scotland (where Presbyterianism is the established system of religion) the Kirk-session, consisting of the minister, or ministers, if there are more than one, and a body of lay elders. In this court the minister presides, but each member has an equal vote. From the decisions of this court an appeal lies to a larger and more influential body, termed a Presbytery, which is usually constituted of the ministers within a certain district, with one ruling elder from each session, and any professor of divinity within the same district, who is also a minister. Several neighbouring presbyteries again combine to form a Synod, in which all the members of the included presbyteries may be represented. The supreme court of the church is the General Assembly, the members of which are appointed either from each congregation, presbytery, or provincial synod, according to different customs prevailing among different churches.

In Scotland Presbyterianism was founded by John Knox about 1560, and after more than a century of strife and persecution it was finally established as the national system of religion at the Revolution of 1688.

The first Presbyterian congregation in England is said to have been formed at Wandsworth in 1572, and its institution was soon afterwards followed by the formation of similar associations in London and in the midland and eastern counties. The Presbyterianism thus established was the object of considerable persecution on the part of Elizabeth and her ministers, under the influence of which it declined considerably; but it revived during the reign of James I., and it became for a short period the predominant system during the years of the Civil War and the institution of the Commonwealth. It gave way to Episcopacy after the Restoration, and from that period its history becomes merged in that of dissent generally. During the eighteenth century a considerable change took place in the doctrinal views of the English Presbyterians, and most of the congregations became Unitarian, those who remained orthodox joining themselves to the Scottish Church. In 1836 a synod of the Presbyterian Church of England was established in independence of the Church of Scotland, and this, at the present period, represents ten presbyteries, about 280 congregations, and 58,000 members.

Presbyterianism was introduced into Ireland from Scotland some time previous to 1642, when the first regular presbytery was held at Carrickfergus, and the Presbyterian Church of Ulster became fairly established by the end of the following year. It had a stormy and troubled existence from the first, and after being persecuted by the Parliament it was almost suppressed by the government after the Restoration. The persecution came to an end with the Revolution of 1688, and during the reign of William the *Regium Donum* of

£600 a year, which had been granted by Charles II., was augmented to £1200. During the eighteenth century many of the congregations became Unitarian in doctrine, and a body opposed to the Westminster Confession was organized about 1726, as the Presbytery of Antrim, the more orthodox party remaining as the Synod of Ulster. In 1840 a union took place between the Synod of Ulster and all the seceding Presbyterian churches of Ireland, the united body taking the title of the General Assembly of the Presbyterian Church of Ireland. At the present period the Presbyterians of Ireland are included in thirty-six presbyteries, representing over 550 congregations, 101,000 communicants, and 620 ministers.

Presbyterianism was first introduced to America by French Huguenot immigrants about the beginning of the seventeenth century, and in 1617 an English Presbyterian Church was established in the Bermudas. Among the Puritan colonists of New England both Presbyterianism and Independency were represented, but both parties co-operated in the country associations, and the differences were less sharply accentuated than in England. During the same century Dutch, Irish, and Welsh Presbyterianism were also planted in the states, and during the earlier years of the eighteenth century the various churches combined to form an organization of a broad tolerant type, the functions of government and discipline being gradually assumed as circumstances required. The adoption by the church of the Westminster Confession in 1720 led to some dissension, which culminated in a rupture in 1741, the two parties being known as the New Side and Old Side respectively. They were re-united in 1758, and after this the church increased rapidly in members and influence, and at the close of the revolutionary war a General Assembly was formed representing 419 congregations. In 1810 a number of churches seceded from the main body, and formed themselves into the Presbytery of Cumberland, and in 1838 the main body divided upon questions of organization, discipline, and doctrine, into two bodies known as the Old and New School Presbyterians. In 1858 the question of slavery led to a further division and the formation of the United Synod of the South. The divisions among the Presbyterians were rendered more complete by the Civil War, and though after its close a union was formed between the Old and New School Churches of the North, all attempts at union between the churches of the north and south have failed up to the present. All branches of the Presbyterians have increased with the growth of the United States; their strength in 1886 was—

	Churches.	Ministers.	Communi- cants.
Presbyterian Church in U. S. A. (North), . . }	5858	5218	600,000
Presbyterian Church in U. S. A. (South), . . }	2040	1070	127,000
Cumberland Presbyterian Church, . . . }	2591	1439	130,000
United Presby. Church, Reformed Presbyterian Church of N. America, }	839	730	85,000
Reformed Presbyterian Church of U. S. A., . . }	124	112	10,500
Associated Reformed Church of the South, }	72	70	6,600
Reformed Church in America, . . . }	516	569	80,156
Reformed Church in U. S. A., . . . }	1465	783	169,000
Calvinistic Methodist, . . }	175	84	9,500

See also ESTABLISHED CHURCH; FREE CHURCH OF SCOTLAND; and UNITED PRESBYTERIAN CHURCH.

PRESCOTT, WILLIAM HICKLING, LL.D., a distinguished American historian, was the son of an eminent lawyer and statesman, and was born in Salem, Massachusetts, 4th May, 1796. He received his earlier education at Salem and Boston, and in 1811 entered Harvard College. An accident during the earlier part of his college course deprived him of the sight of his left eye; but in spite of this disaster he continued his studies and graduated honourably, in 1814. His intention was to adopt the legal profession, but early in 1815 the sight of his right eye became so much impaired that he was compelled to abandon study, and seek recreation and medical advice by a visit to Europe. On his return to America he resolved to devote himself to literature; and after his marriage, in 1820, with Miss Susan Amory, he commenced a regular course of preliminary study, which extended over the next four or five years. His first efforts at composition were some essays and reviews which he contributed to the *North American Review*, and it was not until January, 1826, and after he had contemplated and abandoned several other projects, that he resolved to devote himself to Spanish history. His friendship with Mr. Everett, then United States ambassador at Madrid, enabled him to acquire a large number of original MSS. and rare books bearing upon the events of the period he had selected for investigation, and he was blessed with abundant means and ample leisure. On the other hand, his eyesight, always weak, had now become so much affected that he was unable to use it for more than brief and intermittent periods, and his health forbade him to travel. With the help of a reader, however, and some ingenious mechanical contrivances, he continued his enterprise, and in 1837 he gave the world the first instalment of his labours in his "History of the Reign of Ferdinand and Isabella." The success of this work was immediate and lasting, and after it had been received with much applause in America and England it was translated into French, Spanish, and German. In 1838 he commenced some further studies for a "History of the Conquest of Mexico," and after five years of labour it was published in 1843, its success being proportionate to the wide reputation won by his previous work. In 1845 he was elected corresponding member of the French Institute and also of the Royal Society of Berlin, and the following year he finished the "Conquest of Peru," which appeared in 1847. In 1855 he published the first two volumes of his "History of Philip II.," and a third volume in 1858; but while the latter was passing through the press he had a slight attack of apoplexy, and this was followed by a second, 27th January, 1859, from which he died.

While it is impossible to assign Prescott a position among the great historians of modern times, his works rank as standard authorities on the periods of which they treat, a position fully justified by the large amount of original information they contain and the care and impartiality displayed in the narrative. The style of the historian is clear and easy; his picturing vivid and interesting; and though his views are never profound, nor his insight into character very keen, he never yields either to the intemperate denunciations of the bigot, or to the immoderate partiality of the panegyrist.

A "Life of Prescott," by Mr. G. Ticknor, was published in 1864, and a cheap edition of his historical works was published at London in 1866. A new edition of his complete works was published at Philadelphia in fifteen vols. in 1874-75.

PRESCRIPTION. "No custom is to be allowed, but such custom as hath been used by title of prescription, that is to say, from time out of mind. But divers opinions have been of time out of mind, &c., and of title of prescription, which is all one in the law." (Litt., s. 170.) According to this passage, "time out of mind" and "pre-

scription," which are the same thing in law, are essential to custom; another essential to custom is usage. But there is a claim or title which is specially called prescription, and which is like custom so far as it has the inseparable incidents of time and usage; but it differs from custom in the manner in which it is pleaded, which difference shows the difference of the right. This claim is called prescription, because the plaintiff or defendant who makes it "prescribeth that," &c.; stating after the word "prescribeth" the nature of his claim.

An example of a prescription is contained in Co. Litt., 114. The claim by prescription is properly a claim of a determinate person; the claim by custom, as opposed to prescription, is local, and applies to a certain place, and to many persons, and perhaps, it may be added, to an indeterminate number, as the inhabitants of a parish. The following definition of prescription appears to be both sufficiently comprehensive and exact:—"Prescription is when a man claimeth anything for that he, his ancestors, or predecessors, or they whose estate he hath, have had or used anything all the time whereof no memory is to the contrary." (T. de la Ley.)

Recent Acts have made some alterations as to prescription, and limited the time within which actions can be brought or suits instituted relating to real property. The 3 & 4 Will. IV. c. 27, applies to everything of a corporeal nature, which is land in the sense in which land is interpreted in that Act; but it only applies to three kinds of property of an incorporeal nature, which are advowsons, annuities, and rents. The 2 & 3 Will. IV. c. 100, applies only to cases of modus and exemption from tithes. The 2 & 3 Will. IV. c. 71 (extended to Ireland by 21 & 22 Vict. c. 42, but not to Scotland), which is entitled "An Act for Shortening the Time of Prescription in certain cases," applies (s. 1) to "claims which may be lawfully made at the common law by custom, prescription, or grant, to any right of common or other profit or benefit to be taken from or upon any land, &c., except such matters and things as are therein specially provided for, and except tithes, rents, and services;" (s. 2) "to any way or other easement, or to any water-course, or the use of any water," &c.; and (s. 3) to the use of light. The provisions of the Act cannot be stated much more briefly than in the terms of the Act.

The Acts here enumerated do not apply to a claim "of a manor, a court-leet, a liberty, separate jurisdiction, treasure trove, wreck, waifs, and other forfeitures, fair, market, fishery, toll, park, forest, chase, or any privilege legally known as a franchise, as well as anything pertaining to those rights which come under the description of dignities or offices."

The term prescription is derived from the Roman law, but the original meaning of the term in the Roman law is different.

PRESCRIPTION, in the law of Scotland, supplies the place of the Statute of Limitations in the law of England. It not only protects individuals from adverse proceedings which other parties might have conducted if the lapse of time had not taken place, but it in some instances creates a positive title to property. The prescription by which a right of property can be established is that of forty years—a period probably borrowed from the "prescriptio quadraginta annorum" of the Romans. Whatever adverse right is not cut off by the other special prescriptions of shorter periods, is destroyed by the long prescription. It may be said generally to preclude the right of exacting performance of any claim as to which no judicial attempt has been made to exact performance for forty years from the time when it was exigible. To create a title of real property the long prescription must be both positive and negative. The party holding the property must, by himself or those through whom he holds, have been forty years in unchal-

lenged possession of the property on a title ostensibly valid—this is called *positive prescription*; and the claimant and those whom he represents must have been forty years without an ostensible title, and must, by not judicially attacking it, have tacitly acquiesced in the possessor's title—this is called *negative prescription*.

The other and shorter prescriptions cut off particular descriptions of claims or methods of supporting them. By the *vicennial or twenty years' prescription*, holograph writings, not attested with the usual solemnities of Scottish writs, cease to "bear faith in judgment." An obligation of cautionary or suretiship is limited to seven years. Bills of exchange and promissory notes cease to have force after six years; but the debts they represent, if they do represent debts, may be proved by other means. The *quinquennial prescription* cuts off all right of action, after the lapse of five years, on bargains provable by witnesses. It also protects agricultural tenants from a demand for rent after they have been five years removed from the land to which the demand applies. The *triennial, or three years' prescription*, is very important. It cuts off claims on account for goods or services, the three years running from the date of the last item of the account; and also claims for wages, each year's wages running a separate prescription, and ceasing to be exigible, if not pursued for, in the lapse of three years after the time when it became due. See *LIMITATION*.

PRESENTATION. See *BENEFICE*.

PRESERVED FOOD. Many of the more important food products can, under ordinary conditions, be preserved for a long period without any special precaution beyond keeping them free from damp. Such is the case with the cereal grains, sugar, spices, hard farinaceous and oleaginous seeds, nuts, and some fruits; but most soft succulent vegetables and fruits, and all kinds of animal food require artificial means of preservation if they are to be made available for more than a limited time after their collection and preparation. The subject of the preservation of food has become one of increasing importance during the present century, during which there has been a growing tendency on the part of the populations of old countries to multiply beyond their utmost power of food production, while most of the new countries opened up by colonists and settlers have a large surplus to dispose of. In recent years innumerable schemes of food preservation have been suggested and endless numbers of processes have been patented, but they may all be resolved into four principal classes: (1) desiccation or drying; (2) the addition of antiseptics; (3) the exclusion of air; and (4) exposure to cold or refrigeration.

1. *Desiccation or drying* is undoubtedly the most ancient of all methods used for preserving food, and it is the only method known and practised by many of the primitive peoples of the world. It is most common in the dry, tropical, and subtropical regions of the world, where the heat of the sun is utilized to preserve meat and fish for home consumption or for export. In the River Plate regions of South America, where immense herds of cattle are reared, the meat is preserved by being cut into strips or large slices, and exposed to the sun until it becomes quite dry and hard, forming what is termed *charqui* or *tasajo*. Large quantities of this dried meat are exported to Brazil and the West Indies, and a few years ago an unsuccessful attempt was made to introduce it under the name of *jerked beef* to the English market. It requires prolonged soaking in water before it is cooked, and however carefully prepared generally remains hard and indigestible. Dr. Hassal recommended that the dried meat should be tried in the form of powder, but when introduced it met with no better success than in the other form. Powdered meat, combined with flour and other materials, and made into biscuit, has, however, been used with much success as food for dogs, and the dried extract of beef has been mingled with flour to

make a useful meat biscuit for campaigning purposes. The process of drying is applied also with very satisfactory results to numerous vegetable substances, and dried fruits, such as raisins, currants, figs, dates, apples, and plums, are important articles of commerce. Common pot-vegetables and potatoes are also preserved by drying and pressing for army rations and use on board ship, by means of a process introduced by Messrs. Chollet & Co., of Paris, and these compressed vegetables, when soaked in water and properly cooked, preserve their colour and distinctive flavour so well as hardly to be distinguished from fresh vegetables.

2. *Use of Antiseptics.*—Of the substances of this kind the most ancient and the most commonly used is salt. It acts by driving off the watery juices of the meat, the place of which it takes, and by hardening the muscular tissue; hence, while it has immense preservative value, it generally lessens the nutritive value of the food as well as makes it more difficult of digestion. There are two chief methods of salting meat, the *dry* and the *wet* processes, but the essential principle of both is the same. In dry salting, ordinary culinary salt, mixed with a little saltpetre and sometimes a little sugar, is well rubbed into the meat until every crevice is thoroughly penetrated, and the meat is then placed on a board or in a trough in such a way as to allow the brine to drain off. The pieces are turned and sprinkled with fresh salt from time to time, and are finally packed with fresh salt into barrels. Wet salting or pickling is performed by putting the meat for a few days into a strong brine, after which it is dried and packed with coarse-grained or bay salt. Sometimes after the soaking in brine the meat is further prepared by smoking, as in the case of bacon, or by smoking and drying combined, as in the case of tongues and several varieties of fish. Enormous quantities of the herrings caught in the Scotch fisheries are prepared for export by being pickled for a short time in brine, and afterwards packed in dry salt, which by the exudations from the fish is changed into brine. For vegetable substances salt is not so largely used, but olives are preserved in salt and water, and cucumbers, cabbages, &c., are treated with salt in many parts of the Continent. During recent years many chemical preparations have been brought forward as preservatives, the most prominent being bisulphite of lime, salicylic acid, and various preparations of boracic acid, but up to the present they have not achieved any great success. Vinegar is used to a comparatively small extent as a preservative for animal substances, but it is used on a very large scale for preserving vegetables. Sugar, too, is almost wholly used to preserve vegetable substances in the form of jams, jellies, and candied fruits.

3. *Exclusion of Air.*—This method, now so largely in use, is of comparatively recent invention, having only been brought into use during the present century. It depends for its success upon first heating the material to be preserved to such a degree as to kill living germs, and then carefully excluding all atmospheric air. To attain this, the portions of meat, fish, &c., to be preserved are cut into small pieces and closely packed in metal cases, upon which the lid is soldered, leaving only a small pin hole open at the top. They are then immersed to within an inch or two of the top in a solution of chloride of calcium, which boils at a temperature of from 260° to 270° Fahr., and the heat is gradually raised until all the air is expelled with some of the moisture through the pin hole; the latter being promptly closed by a drop of solder as soon as the contents have reached this stage, and the tin, after being kept for a short time wholly immersed in the solution, is drawn out and allowed to cool. Mutton and beef have been imported in this form in large quantities from the colonies, but the method is now giving way somewhat before the refrigerating process noticed below. Lobster and salmon, however, are still largely imported in this form, and tinned peaches, apricots, pine-apple, &c., have become important

articles of commerce. Sardines cooked in oil and preserved with it in closely sealed tins are also a well-known form of preserved food.

4. *Refrigeration*.—The antiseptic power of cold has been known from the earliest times, and in many countries where the winters are severe and prolonged, the people have been accustomed to preserve their winter stores by freezing from time immemorial. A remarkable instance of the preservative power of cold has already been noticed under MAMMOTH, and many further curious instances might be adduced from the annals of mountaineering and Arctic explorations. It was not, however, until the year 1875 that the cold process was introduced on any large scale for the preservation of fresh meat during its transit from America to Europe. At first the carcasses were hung in a large chamber, which was kept cool by continually blowing into it air that had been cooled by passing through reservoirs of ice, but this method was superseded in 1879 by the introduction of the Bell-Coleman dry-air refrigerator, in which the low temperature is obtained by cooling a compressed column of air and afterwards allowing it to expand. In 1880 this process was successfully used to bring some shipments of fresh meat from Australia, and two years later over 8000 carcasses were brought from New Zealand. Since then the trade in frozen meat has increased by leaps and bounds, and there can be no doubt that this process is destined to exercise a still greater influence over the food supplies of the future.

PRESS, BRAMAH'S. See HYDRAULICS.

PRESS, CENSORSHIP OF. See CENSORSHIP OF THE PRESS.

PRESS, LIBERTY OF THE. Almost immediately upon the invention of printing, the church took alarm at the power of the diffusion of knowledge thus gained, and speedily, under the pretext of moral and religious necessity, gained the right of control over the press in almost all countries more or less. In England, at the Reformation, the censorship of the press was taken from the church and handed over to the Court of Star Chamber. Queen Mary limited the number of printers, and Elizabeth, in her first year on the throne, made it illegal to issue any book without the *imprimatur* of the licenser (1559). This last regulation was further enforced twenty-six years later (1585), the licensers being the Archbishop of Canterbury and the Bishop of London, and for law books only the chief justices, while printing was restricted solely to Oxford, Cambridge, and London, and all the presses were registered and regularly inspected. James I. and Charles I. kept these stringent laws going in full force from dread of the Puritans. Prynne, for example, was pilloried and imprisoned for publishing his unauthorized "Histriomastix" in 1634, and for a further publication was branded and lost his ears in 1637. When the Long Parliament came into power the scale was turned with equal vigour against the Royalists, so that Milton in his high-souled scorn put forth the flaming "defence of unlicensed printing," which he called "Areopagitica" (1644). All he got by it, however, was the appointment of committees to regulate the censorship (1644).

The Licensing Act of Charles II. (1662) limited all printing whatever to the "Universities of London and York," and then only by twenty master-printers in all, and by the consent of licensers; and this Act was renewed every three years to 1680. In the latter year Chief-justice Seroggs declared that all news printed without license was illegal and punishable. In 1685 the Licensing Act was passed under James II. for seven years, extending afterwards to 1694; but the Commons, now under the enlightened rule of William III., refused to renew it in 1695, and the press was declared formally free. Two circumstances, however, still restrained it. The first was the strained interpretation of the law of libel; and the second the

imposition of the stamp duty in 1712, a tax on knowledge which, *marabile dictu*, continued to exist for 143 years, and was only abolished in 1855.

PRESS-GANG. See IMPRESSMENT.

PRESSURE is the condition of matter when a force acting upon it is resisted and counteracted by another force; in this state of things no motion is produced, and the pressure exactly represents the motion which has been prevented from accruing on the application of the acting force by the resistance of the reacting force. The force of gravity acts on a book, but the table prevents the book from falling, and its resistance produces the state of pressure. The acting or outside force in pressure is called the thrust, the reacting or inside force is called the reaction. When two equal and opposing forces are both outside, pulling, therefore, in opposite directions, we have not a pressure but a tension or strain, the first applied to a flexible body, the second to a rigid body.

PRESTER JOHN, a supposed Christian priest-king of Central Asia in the dark ages. Sir John Mandeville says he was a descendant of Ogier the Dane, and penetrated northwards of India with some of his Christian barons, who conquered, converted, and divided the country among them. His missionary powers gained him the name of "priest" (*presbyter* or *prester*). Benrice offers as a specimen of impossible things to "bring the length of Prester John's foot," in the "Much Ado about Nothing" of Shakspeare; and Prester John was held to be so holy as to be visible only thrice a year to his subjects.

The truth seems to be that, when the Nestorian missionaries penetrated into Central Asia, they converted certain Tartar tribes, and among others the Keraites ruled by Ung Khan. Khan has a sort of religious meaning, that is, the Khan is supreme over the religion as well as over the secular concerns of his tribe, and Ung was not unlike John, whence the good Nestorians turned the Tartar Khan Ung into the Syriac priest John. They sent a very favourable report of Prester John's Christianity and of his great powers to Pope-Eugenius III. in 1152, with letters written in the Khan's name to other sovereigns as well as to the Pope himself. (See the originals in Assemani's "Bibliotheca Orientalis.") The famous Genghis Khan was in his youth a fugitive to Ung Khan (Prester John), and later on became his vassal. He rebelled against him, and defeated and slew him in 1202. Father Carpini, sent to Batu Khan (grandson of Genghis Khan) by Innocent IV. about 1250, ascertained that Prester John's country lay further eastward. Subsequently another Franciscan friar, Father Rubruquis, was sent to Batu Khan by St. Louis, king of France, and he really did penetrate to the Nestorian missionary station. But the then Khan was an unbeliever, the missionaries were wretched and useless, and evidently had grossly exaggerated their whole position. (See Purchass' "Collection of Voyages.") Others have believed that Prester John's country was to be looked for in Abyssinia, and that this is the origin of the Christian church of that land.

PRESTON, a port and municipal and parliamentary borough in Lancaster, on the northern bank of the Ribble, about 15 miles above its mouth; 210 miles N.N.W. from London by the North-western Railway, and 21 miles south from Lancaster.

Preston, or "Priest-town," as it was originally called, from its numerous clergy, was planted here on the decay of the Roman city of *Coccium*, now *Ribchester*, 7 miles N.E. It stands on elevated ground sloping to the Ribble, which is crossed by six bridges. The houses are well built and supplied with abundance of water. During the cotton famine, under the Public Works' Act, a system of drainage was carried out, and many of the streets paved and improved. About the same time the large space known as Moor Park on the north, with Avenham and Miller Parks

on the south of the town, were laid out, planted with trees, and all three opened to the public in 1867. There are numerous churches, fifteen Church of England, four Chapels of Ease, twenty-two Dissenting, three School chapels, and seven Roman Catholic chapels. Of these the largest is St. Walburga's, with a beautiful tower and spire over 300 feet high, which is visible for many miles around. The other public buildings include the town-hall, opened in 1868, a splendid edifice in the *Hôtel de Ville* style, with a lofty clock-tower; the guildhall is in the interior, and on the basement the exchange; free library, museum, and art gallery in the Classical style; county buildings, corn exchange, and market-house, with assembly room above. The arena, which was enlarged in 1882, contains a fine organ, and is the largest public room in Lancashire. There are five banks, a neat theatre, court-house, and infirmary; Winkley, Conservative, and Reform clubs; a Catholic orphanage, county gaol, gas offices, baths, and almshouses. The grammar school is in the Tudor style, and there are many other schools throughout the town. A handsome statue of Lord Derby was erected in Miller Park in 1873, and in recent years the street architecture has been much improved. The institute at Avenham has been considerably enlarged since 1882, and is now used as a scientific and technical school. It possesses a very fine laboratory, and is now known as the Harris Institute. At Fulwood, $1\frac{1}{2}$ mile north, are extensive barracks and a workhouse. There are two free public libraries, and one law library.

Preston was formerly a quiet place, the only manufacture being a little linen, until cotton was introduced in 1777. After 1791 several mills were built, and the population rapidly increased. It was a noted place for strikes; one of these in 1853-54 lasted over eight months, and the estimated loss to the community was £533,000. But the greatest blow to its prosperity was the American War, 1861-65, when all the mills were closed and the work-people suffered severely. Many then left the town, and the trade has never been so flourishing since. There are between seventy and eighty mills in the town and environs, employing about 30,000 hands. Arkwright was a native of this place. There are several iron and brass foundries and machine shops, while malting, brewing, tanning, wire and rope making are also carried on. Within the last few years iron-shipbuilding has come to the front, and several large vessels have been launched here. Though navigable for ships of considerable burden the Ribble is ill adapted for trade. Improvements have from time to time been effected, and in 1883 the corporation purchased the rights, &c., of the Ribble Navigation Company. Plans having been prepared, an extensive scheme was begun in October, 1884. The works comprise the diversion of the river to the south, cutting off a bend, training walls as far west as Lytham, dredging the river bed to a depth of 30 feet below ordinary spring tides, and the construction of a wet dock 40 acres in extent, together with graving docks, hydraulic lift tips, &c. The railway runs down to the quays. The works, which are estimated to cost about £500,000, are to be completed in 1889. The imports consist chiefly of coal, iron, and timber. Coal is the principal article of export. The Lancaster Canal traverses the west side of the town, and connects it with the great canal system of the manufacturing districts. Tramways run along the main streets. Preston is a great railway centre, and has three stations; the largest, one of the finest in the kingdom, opening upon Fishergate, was completed in 1880 at a cost of over £200,000. A large hotel in connection overlooks the park. A trades jubilee is held in Preston every twentieth year, in September. The last took place in 1882.

The borough is divided into six wards, and is governed by a mayor, twelve aldermen, and thirty-six councillors. The municipal and parliamentary limits are nearly identical, and the population in 1881 was 96,582. Two members are

returned to the House of Commons. Preston possesses no fewer than fifteen royal charters granting, confirming, and enlarging certain privileges to the burgesses. The first of which there is any record is one without date, granted by Henry II., but from internal evidence it is clear that it must have been granted within the ten years of his reign, between 1175 and 1185. This charter grants to the burgesses of Preston "all the same liberties and free customs" which had been given to the burgesses of Newcastle-under-Lyme; and these were that the town be "a free borough, and that the burgesses aforesaid may have a Guild Mercatry, with all liberties and free customs to such guild appertaining. And that they may go through all our land with all their merchandises, buying and selling and trafficking, well and in peace, freely, quietly, and honourably. And that they may be free from all toll, passage, pontage, stallage, lackage, and all other customs." The first recorded guild merchant was held in the second year of the reign of Edward III. (1328), but as in the orders made at that guild there is reference to the "orders of a precedent guild," there is hardly a doubt that a guild merchant had been held in Preston many times before that date. It is known that such institutions are of Saxon origin, and Preston was a town in Saxon times, as is proved by its church, then dedicated to St. Wilfrid, being one of three that are mentioned in Domesday Book as existing in the hundred of Amounderness. There are records in existence of twenty-three guilds, and of these the corporation possess the rolls of nineteen, including a complete sequence of fourteen, and of the orders of each guild, from 1662 downwards.

Though Lancaster is nominally the seat of the County Palatinate, its judicial courts are held at Liverpool and Manchester, while its principal officers are at Preston. Preston was partly destroyed by Bruce in 1323. During the Civil War the town changed hands, and the mayor was slain in an assault. In 1648 Cromwell defeated the Royalists close by, and in 1715 the insurgent army was compelled to surrender here. Prince "Charlie" also passed through in 1746.

PRESTONPANS', a burgh of barony and parish of Scotland, in the county of Haddington, on the Frith of Forth, $8\frac{1}{2}$ miles east of Edinburgh. Population of the parish, 2573; of the village, 2265. It is a straggling and ill-built place; has some ale breweries and soap works, and had formerly some salt-pans (from which the town takes its name). The port of Morrison's Haven is half a mile west of the town. The oysters dredged near it are in great repute and are called *Pandores*, as being found at the door of the pans. Near it was fought the battle between the royalist army and Charles Edward Stuart, the Pretender, 21st September, 1745, when the latter gained the victory.

PRETORIA, the seat of government of the Transvaal, South Africa, is centrally placed in the south of the colony, 320 miles in direct distance N.W. Natal, and 1050 miles from Cape Town. It lies between the Maghales Berg, near its eastern extremity, and the heights called the Witte Waters Rand, 4450 feet above the sea. It contains the government house, churches, club, bank, &c., and has a public market. The district of Pretoria includes highfield, terrace, and bush country, with a healthy climate, and generally well adapted for stock raising.

PREVESA (the ancient *Nikopolis*), a town in European Turkey, on the north side of the entrance of the Gulf of Arta. Its situation made it an object of desire to the Venetians, who obtained possession of it in 1684. In 1798 it fell into the hands of the French, but the town was soon after taken by an Albanian force under Ali Pasha's son Muktar. The oppressive government of Ali quickly reduced the population, which at that time was about 10,000, and annihilated the commerce of the town. Ali made

Prevesa his chief naval station, fortified the town with new works, and adorned it by the finest palace or seraglio in his dominions, built at the entrance of the bay.

The present population is said to be about 8000. The chief articles of export are wheat and maize, timber, oil, tobacco, cotton, wool, and capotes, or Albanian cloaks. The imports are coffee, sugar, common cloth, velvet, iron goods, fire-arms, &c.

PREVOST D'EXILLES, ANTOINE FRANÇOIS, ABBÉ (born 1697, died 1763), was a native of Picardy, and was educated by the Jesuits. He served as a soldier for a short time, but eventually returned to his first idea, that of entering a religious order, and became a Benedictine at twenty-four. For six years he was a diligent student and teacher. He then grew so weary of the convent that he applied for a release, but impatiently neglected to wait for it—a breach of discipline that drove him into exile from France till 1735. He visited England during this time, was much struck with Addison's *Spectator*, and on his return to France started more than one imitation of it. He was a laborious literary man, and his works if collected would form 100 volumes. But all of these are now unread, while a small volume, only an episode or postscript of another book ("Mémoires d'un Homme de Qualité"), raises the abbé to the rank of a man of genius. This book is the famous "Manon Lescaut" (1733), the tale of the love of the Chevalier des Grieux for a worthless girl, whose overmastering desire for luxury and comfort drives her down to the lowest degradation, yet without altogether destroying her charm. The subject is unpleasant, but it is pleasantly handled, and the characters are simply alive. No one who reads this remarkable little book can forget it, for it is absolutely true to nature. It ranks with "Tom Jones" and "Amelia," and, like them, is altogether beyond criticism, for it forms in itself a canon whereby to criticise other works. The death of poor Prevost was most sad. He fell on the way to Chantilly, where he lived, struck down senseless by a fit of apoplexy. A doctor was called in, after the supposed death had been made sure of, and was directed to make a *post-mortem* examination. At the first stroke of the knife the poor man returned to his senses, but the wound was so severe that he very soon expired in much agony.

PRIAPUS (Lat. *Priapus*), in the Greek mythology, was the son of Dionysos and Aphrodité. He was so angry at the ill-conduct of the goddess of beauty that to punish her she caused the child to be very ugly. He was usually regarded in Attica as the god of licentiousness; but elsewhere, as along the Hellespont, he was worshipped as the god of fertility, protector of sheep and goats, of bees, of vineyards and orchards, &c. The sacrifices in his honour consisted of milk, honey, and asses. He was represented as a man holding fruit in his lap and a pruning knife in his hand. In the depraved view of him he was represented by a phallus or in *hermæ* (square pillars ending in a head or bust). The Romans also called him *Latinus* or *Mutunus*.

PRICE. The terms *price* and *value* were used as synonymous by the early economists, but most modern writers have given them distinct and separate meanings. Value is, briefly speaking, general purchasing power, or power in exchange [see *VALUE*]; price is purchasing power expressed in terms of some one article—power-in-exchange for that article, be the same wheat, or beef, or wool, or gold, or silver. It is equally correct to say that the price of a horse is seventy-five bushels of wheat, as to say that it is £20. In common speech, however, the word brings up the idea of money-value, the purchasing power of an article expressed in terms of money, and, unless otherwise stated, it is in this sense that it is now generally used by economists. It follows as a consequence of the distinction just described that though there may be a general rise of prices, there cannot be a general rise of

values. All things cannot rise relatively to one another. If one half of the commodities in the market rise in exchange value, the very terms imply a fall of the other half; and reciprocally, the fall implies a rise. In the case of a general and equal rise or fall of prices, the only thing which is really altered in value is money. An increase of the demand for money will enhance the value of money, and if money purchases more of other things, other things, conversely, purchase less of money—that is, bear lower prices. On the other hand, to say that the value of money is lowered, is to say that money purchases less of other things; but if money purchases less of other things, other things, conversely, purchase more of money—that is, bear higher prices.

The term natural or normal price is used to signify one which corresponds closely to the cost of producing a commodity by those individuals who produce it under the least favourable conditions of all who contribute to the supply of that commodity.

Market price generally differs more or less widely from the normal price, as it must always measure the utility of a commodity to the last purchaser, that is, the person to whom it is just worth while to buy of it at that price; but does not necessarily measure the efforts and abstinences of the last producer, that is, the person producing under the greatest disadvantage, to whom, therefore, it is only just worth while to produce at that price. (Walker's "Political Economy.")

PRICE CURRENT, in commerce, a weekly account of the current value of all commodities which are articles of commerce, with the duties (if any) payable thereon when imported or exported.

PRICKLY PEAR (*Opuntia*) is a genus of plants belonging to the order Cactew. The species are numerous, and confined to the warmer regions of America, being found chiefly in Mexico, California, Brazil, Chili, and Peru. They are erect or decumbent, growing to the height of 8 or 10 feet, and have generally fleshy, spiny stems, and branches formed of thick compressed articulations; as they get old most of them form a short round woody trunk; in some the stems and branches are cylindrical and unjointed. The young shoots produce very small, cylindrical, fleshy leaves, which soon drop off. The flowers spring from among the clusters of bristles with which the branches are covered, and are generally yellow or reddish in colour. The fruit is pear-shaped or oval, with numerous prickles on the rind, which is thick and fleshy, and incloses numerous seeds embedded in pulp.

The Tuna (*Opuntia Tuna*), a native of Mexico, the West Indies, and South America, has been naturalized in many parts of Southern Europe and in Northern Africa, Madeira, and the Canaries. It is a large species, the erect woody trunk being sometimes as much as 20 feet high. The pear-shaped fruit is about 3 inches, and of a rich carmine colour; the pulp contains a sweet, cooling juice, which is very grateful in hot countries. The stems, from their strength and spiny character, are used for hedges. From the fibres of the trunk and old branches the French colonists of Algiers make baskets, &c. In Mexico plantations of the Tuna are cultivated for the sake of the cochineal insect, which feeds upon it. The Common Prickly Pear (*Opuntia vulgaris*) has also been naturalized in Southern Europe, Northern Africa, the Canaries, &c. The fruit is oval, rather larger than a hen's egg, yellow in colour, tinged with purple. The fruit is imported to a small extent into this country from the Mediterranean. In some parts of the south of England this plant grows in the open air, and occasionally ripens its fruit.

PRIDE, COLONEL, of "Pride's Purg" celebrity, first emerges (as lieutenant-colonel) at the end of March, 1647, summoned with two other officers to appear at the bar of the House of Commons, in the controversy between

the Parliament and the army, a little before the seizure of Charles I. at Holmby House. He commanded a regiment of foot at Preston. When a majority of 129 members of the House of Commons voted that the king's concessions at Newport formed a ground of settlement, Colonel Pride and his foot soldiers occupied Westminster Hall, and all the entrances to the House of Commons, on the 6th of December, 1648. Pride himself held in his hand a written list of the names of the 129, and Lord Grey of Groby stood as prompter by his side. When any one of the 129 approached Pride gave the word, and the honourable member was marched off to a place of temporary confinement. This was the famous achievement known in history as "Pride's Purge."

Pride accompanied Cromwell in the Scottish expedition, and helped to bring up the rear at Dunbar. His last appearance, so far at least as we have been able to trace him, is as a member of Cromwell's House of Peers in 1658. His body was ordered by the royalists of the Restoration (1660) to be disinterred and hanged at Tyburn.

PRIESSNITZ, VINCENZ. See HYDROPATHY.

PRIEST (from the Greek *presbuteros*, an elder), in its popular acceptance, is the name of a minister of religion in all ages and countries. The term *priest* is also used to express the Hebrew *kôhen*, the Greek *hiereus*, and the Latin *sacerdos*, words which denote a minister whose chief duty is to offer sacrifices on the behalf of the community. Officials of this class are to be found in connection with nearly all definite forms of national or tribal religion, and we find that considerable influence was exercised by the priesthoods of all the great religious systems of ancient civilization. A very elaborate and carefully organized system of priesthood prevailed in ancient Egypt, where the Pharaoh was always the centre and head of the system, and where the higher priests were constituted great officers of state, endowed with large civil and even military power. The Egyptian priesthood, in addition to the charge of the national worship, included, among their functions, the practices of divination and astrology, and they appear to have kept the power of education in their hands, and to have been the chief representatives of learning in the nation. The history of Babylonia is less known than that of Egypt, but there is good reason to believe that the Chaldean priests held a position in the state very similar to that occupied by their brethren in Egypt, and while they practised magic and astrology they accomplished much genuine work in the study of astronomy and its cognate sciences. There is no indication of the existence of any priesthood in the literature of the earliest periods of Indian history, but we have noticed under **BRAHMANISM** the way in which the primitive composers and singers of the sacred songs developed into a sacerdotal caste, which ultimately became the most powerful in the nation. In Greece the priests, although they were well endowed by the gifts of the devout, and the share allotted to them of the frequent sacrifices, and were considered to be under the special protection of the deity to which they ministered, they never, as a class, attained to a position in the nation equal to that of the priesthoods of Egypt or India. In Rome also the priests, although intrusted with important functions, were yet kept subject to the state, and ritual and observances were regulated by the pontifices and augurs.

Among the Hebrews we find no trace of any organized priesthood during the first, nomadic, period of their history. Their worship indeed included the offering of gifts from the field and the flock to the deity, but the head of each family combined in himself the offices of ruler and priest, and these offices descended with the birthright, and apparently might be transferred with it. So far all authorities are agreed, but there is a wide divergence of opinion as to the origin of the priestly order among the Israelites, and its position in the nation previous to the centuries immedi-

ately preceding the Christian period. The traditional view, generally accepted until a recent period, was, that the whole system was appointed and regulated by the great lawgiver, Moses, previous to the entry of the people into Canaan, many of the externals of ritual, dress, &c., being copied from the Egyptian priesthood, while others were of special and supernatural appointment. It had been observed that the subsequent history of the people showed that many of the enactments of the Pentateuch were disregarded, but this was regarded as a national falling away from righteousness, and the reforms of the closing period were regarded as being a return to the earlier observances. The opposing theory, which has obtained most acceptance among modern scholars, is intimately involved with the new view of Hebrew history noticed under **JEWS** and **PENTATEUCH**. Some of the more important features of this theory have already been given, and it will be sufficient here to notice that it places the origin of the elaborate priestly organization given in the Pentateuch, near the close, rather than at the commencement of the nation's history. The origin of a separate class of priests is traced, in accordance with this theory, to the existence of soothsayers and keepers of certain national sanctuaries and minor sacred places. Wherever there was a sacred place there was set up in connection with it an oracle and a sacred lot, which it was the privilege of the keeper or priest to consult, and to which all questions of importance that could not be settled by ordinary means were referred. In the course of time the priests became the depositaries of the sacred law of the nation, and as the latter became consolidated and powerful, the dignity and importance of the priestly office rose with it, the priests of the royal sanctuaries being among the highest functionaries of the kingdom. During a long period the priests combined the two functions of teaching the law and conducting the worship at the sacred places, though on special occasions kings, prophets, and others offered sacrifices, in accordance with primitive custom, without calling for any priestly intervention. During the exile it is supposed that a new hierarchical organization was devised, and it was after the return and the re-establishment of the nation in Palestine that the priesthood became the centre of the national life, and the high priest the chief embodiment of its hopes and aspirations. The division of the sacred order into Priests and Levites, it is assumed, dates at its earliest from the fifth century B.C., there being only one class, "the priests, the Levites," before this. At the time of Jesus the priests had become very numerous, and, divided into twenty-four courses, they conducted with an elaborate ritual the all important services of the temple.

In the Christian church no provision was made during the earlier periods of its history for the appointment of a priesthood, and it is impossible to find in the New Testament any trace of the establishment of an order bearing the name or exercising functions corresponding to those of the Jewish priesthood. On the other hand, it is assumed that while Jesus had become the high priest of his people by the offering of the sacrifice of himself, he had made all his followers kings and priests, with the right of free access to the divine presence. In the foundation of the first Christian communities also we find no officer possessing the peculiar functions of the priesthood, and it was not until the episcopal system had become generally established that the idea was conceived which made the bishops, presbyters, and deacons of the new dispensation the representatives and successors of the high priest, priests, and Levites of the old. The idea that the priests of Christianity exercised sacrificial functions was developed in connection with the doctrine of the mass, and the priesthood of the Christian church became one of the grades of its hierarchy, second in importance only to that of the bishop. In the Roman Catholic Church the priest is the only minister of the

Eucharist and the ordinary minister of baptism, penance, and extreme unction, as well as the instructor of his flock and the director of their spiritual concerns. In the formularies of the Church of England the term priest is used in its original sense of presbyter, and points out the second degree of the minister, to be admitted to which a man must be, according to the thirty-fourth canon, of the age of "four and twenty years complete." The special office of the priest is to celebrate the sacrament of the Lord's Supper; to pronounce the form of absolution in the morning and evening prayer; and to preach, though this last is, by special license, generally extended to deacons. In the Roman Catholic Church priests are bound to a life of celibacy; in the Greek Church married men may be advanced to the priesthood, but no one is permitted to marry after ordination, nor is a married priest allowed to marry a second time, should his wife die. The Protestant churches at the Reformation for the most part took up the position that there was no sacrifice in the mass, and therefore no priesthood in the official sense—a position still maintained and defended by the majority of Protestants.

PRIESTLEY, JOSEPH, the son of Jonas Priestley, a cloth-dresser at Birstal-Fieldhead, near Leeds, was born at Fieldhead, 18th March, 1733, old style. At the age of nineteen (1752) he entered the dissenting academy at Daventry conducted by Dr. Ashworth. During his residence at the academy he composed the first part of his "Institutes of Natural and Revealed Religion," published in 1772; the remaining three parts in 1773-74.

On quitting the academy in 1775 he became minister to a small congregation at Needham-Market in Suffolk, at an average salary of £30 per annum. His free opinions, however, occasioned his congregation to desert him, and he maintained himself by keeping a school at Nantwich, in Cheshire. While at Needham he composed his work entitled "The Scripture Doctrine of Remission," &c., published in 1761, the year in which he succeeded Dr. Aikin as tutor at Warrington Academy. Here he composed several works, among which is "The History and Present State of Electricity, with Original Experiments" (1767). In 1766 he had been elected a member of the Royal Society, and about the same time the honorary title of Doctor of Laws was conferred upon him by the University of Edinburgh. The approbation bestowed on his "History of Electricity" induced him to compose his "History and Present State of Discoveries relating to Vision, Light, and Colour" (two vols. 4to). He relinquished his appointment at Warrington in 1767. His next engagement was at Mill-hill Chapel, Leeds, where he published a pamphlet on "Impreguating Water with Fixed Air" (1772); the same year he communicated to the Royal Society his "Observations on Different Kinds of Air," to which the Copley medal was awarded in 1773. To chemistry, indeed, he rendered important services. He discovered oxygen gas (which he called dephlogisticated air), nitrous gas, nitrous oxide gas, nitrous vapour, carbonic oxide gas, sulphurous oxide gas, fluoric acid gas, muriatic gas, and ammoniacal gas. In 1778 he received the appointment of librarian and literary companion to the Earl of Shelburne, with a salary of £250 a year and a separate residence. The connection lasted until 1780, when Priestley retired with an annuity of £150 a year.

Priestley's vigorous opposition to the church now began to increase the number and importance of his enemies. His "Familiar Letters to the Inhabitants of Birmingham" exasperated the populace of that town, where he was then residing and ministering to the principal congregation of dissenters; and his "Reply to Burke's Reflections on the French Revolution" having given rise to a public dinner, on 14th July, 1791, in celebration of the anniversary of the destruction of the Bastille, at which, however, Priestley himself was not present, the excited mob rose, and after

demolishing the place where the dinner had been given, they broke into his house, destroyed his philosophical apparatus, a valuable collection of books, and a large number of manuscripts, after which they made an unsuccessful attempt to burn the dwelling and what was left in it. In the meantime he and his family were forced to seek safety in flight. The sum awarded to him at the assizes as compensation is not stated, but he tells us that it fell short of his loss by £2000. Individual generosity made amends. Among other instances of this kind, his brother-in-law made over to him the sum of £10,000, invested in the French funds, besides an annuity of £200 a year.

After this he removed to Hackney, but finding his society shunned by many of his former philosophical associates, he embarked in 1794 with his family for America, and took up his abode in Pennsylvania, where he died on 6th February, 1804, expressing the satisfaction he derived from the consciousness of having led a useful life, and the confidence he felt of a happy immortality in a future state. A handsome statue to him was erected in Birmingham in 1874.

See the collected edition of Priestley's works, in twenty-five vols., edited by John Towill Rutt (issued at Hackney, 1817-32), and his "Life," by John Corry (Washington, 1875).

PRIMAGE. Originally primage was a certain proportion of the amount of the freight paid to the captain of the vessel to insure his taking the greatest possible care of the cargo. But now other arrangements have been made as to the captain's remuneration, and the primage (often about a tenth of the freight) is now simply an additional item charged for the shipowner's benefit.

PRIMARY, in geology, the old term applied to the great succession of formations now more commonly called **PALÆOZOIC**. According to the same nomenclature the **MESOZOIC** deposits are termed **Secondary**, and the **CENOZOIC Tertiary**.

PRIMATE, the chief ecclesiastic in the church. In England the Archbishop of York is entitled Primate of England; the Archbishop of Canterbury, Primate of all England.

PRIMATES was the name given by the great Swedish naturalist Linnæus to a group of **MAMMALIA**, including man, the apes and monkeys, the lemurs and the bats. The last have for long been separated into a distinct order, **Chiroptera**; and till recently it was usual to follow Cuvier's example and form a distinct order, to which the name **Bimana** was given, for the reception of man—the apes, monkeys, and lemurs forming a second order, **Quadrumana**. From a zoological standpoint, however, the separation of man from the anthropoid apes is unjustifiable. The name **Quadrumana** (four-handed), too, is a misnomer, for, as anatomists have shown, the hind foot of these animals is in all essential characters a true foot, that of the highest apes differing only from the human foot in the greater opposability of the great toe. The lemurs differ in many important respects from the rest of the order, and accordingly are usually placed in a distinct group, to which the names **Prosimia** or **Lemuroidea** are given. See **LEMUROIDEA**.

The order **Primates**, then, in modern classifications, includes man, the apes, and the monkeys, agreeing in the opposable character of the pollex or thumb and the hallux or great toe, in the discoidal, deciduate placenta, and in the presence of four incisor teeth in each jaw. It is divided into two great groups distinguished by anatomical peculiarities and geographical distribution.

The **Catarrhini** (to which group man belongs) are confined to the Old World. They have the nostrils close together, separated only by a narrow gristle. The dentition is as follows:—

$$I. \frac{2-2}{2-2}; \frac{1-1}{1-1}; pm. \frac{2-2}{2-2} m. \frac{3-3}{3-3} = 32.$$

The tail is never prehensile, and sometimes quite rudimentary. The lower forms are supplied with capacious cheek-pouches, in which they stow away food for future consumption. The buttocks in all except the highest forms are provided with naked thickened patches or callosities, which are often vividly coloured.

Man (*Homo sapiens* of Linnæus) forms the first subdivision or family, Anthropini, of Catarrhini. The extent to which he differs physically from the man-like apes is discussed in the article MAN.

The man-like apes form a section, Anthropolomorpha or Simiada. The apes included in this division are the gorilla [see Plate, fig. 1] and the chimpanzee, forming the genus *Troglodytes*, the orang-utan (*Simia*), and the gibbons (*Hylobates*).

In the group Cynomorpha or Dog-shaped Monkeys are contained the remainder of the Catarrhini. The most important of these are the Semnopitheciada (fig. 2), which have no cheek-pouches, the Gueonids (*Cercopithecus*), the Macaques (*Macacus*), one of which, the Barbary Ape, is the only monkey found in Europe, and the Baboons (*Cynocephalus*).

The suborder Platyrrhini contains the monkeys of America. The nose is broad and flat, the nostrils being placed wide apart, separated by a broad gristle, so that the openings look outwards. The dentition is as follows:—

$$\begin{array}{cccc} J. & \frac{2-2}{3-3} & 1-1 & pm. \frac{3-3}{3-3} \quad m. \frac{3-3}{3-3} \quad 36. \end{array}$$

Thus there is one premolar more on each side in each jaw than in the Old World forms; in one family, however, the Marmosets (*Hapalidæ*), there are only two molars on each side in each jaw, so that the number of teeth are the same as in the Catarrhini, but differently arranged. No cheek-pouches nor callosities are present. In many the tail is very long and prehensile.

The Cebidæ (figs. 3-5) are the typical monkeys of the New World, being all provided with a long prehensile tail, which in some is usually so useful as to form "a fifth hand." This family contains the Howlers (*Myctes*), the Spider Monkeys (*Ateles*), and the Capuchins (*Cebus*). The Pitheciidæ form another family, with the tail often long, but never truly prehensile; in it are contained the Squirrel Monkeys (*Callithrix*, fig. 6), the Night Apes (*Nyctipithecus*), and the Sakis (*Pithecia*). The Marmosets (*Hapalida*, fig. 7) form a distinct group of American monkeys, often called Arctopitheciini or Bear-monkeys. They are of small size, with only two molar teeth on each side in each jaw, non-prehensile tails, and the pollex furnished with a claw and scarcely opposable.

PRIME or **PRIME NUMBER**. See NUMBER.

PRIME TONE, the lowest and usually the most powerful partial tone in an ordinary musical sound; that into which the other partial tones melt, manifesting themselves only by their modification of its quality or timbre. The prime tone, except in certain very low notes, is that which the ear consciously hears, and by which it determines the pitch of the note in question. See ACOUSTICS, PITCH.

PRIMOGENITURE may be defined as that rule of English law by which a title of dignity or an estate in land descends to a person in respect of his being an eldest male. It came into England with the feudal law in 1068. If a man dies seised of real estate, of which he had the absolute ownership, without having made any disposition of it by his last will, the whole descends to the heir-at-law or customary heir; and the heir-at-law is such by virtue of being the eldest male person of those who are in the same degree of kindred to the person dying, or the representative of such eldest male. [See DESCENT.] This is a case in which primogeniture operates. A common example of primogeniture is where a father dies absolutely

entitled to real estate, and without disposing of it by will, in which case his eldest son takes it all. If land is settled or entailed on a man and his male issue, the eldest son takes the land by two titles, first as being a male, and next as being the eldest son. The law of primogeniture only applies in the case of land when the owner in fee dies without having made any disposition of it by will, or where the land is settled on a man and his male issue. It does not apply when the interest in land is a chattel interest, or a term of years; nor does it apply when real estate descends to daughters as coparceners.

At present those who are the absolute owners of large landed estates seldom die without making a disposition of them by will. In the case of lands which are settled, the person in possession is generally tenant for life, and the inheritance is entailed on the eldest son. When the eldest son is about to marry, it is usual for the father and son to take the usual legal steps (which they can do as soon as the son is of age) to unsettle the estate and obtain the absolute ownership. They then resettle the estate, making the father tenant for life as before; the son, who was before tenant in tail, is also made only a tenant for life; and the inheritance is settled, as before, on the eldest son of the intended marriage. Such eldest son takes the estate, not as heir, and therefore not by the law of primogeniture, but he takes it as the person designated by the deed of settlement.

When a man happens to be tenant in tail, he usually takes the legal steps necessary (which he can do as soon as he is of age) to acquire the absolute ownership of the property, which he then generally settles again by deed or will, or disposes of absolutely.

It is usual in England to settle all large estates, and the object of the settlement is to keep the estates together, and to perpetuate them in one family; but there is a limit to this power of settlement. A man cannot, either by deed or will, settle his land, so as to prevent the absolute ownership of it from being obtained, for a longer period than a life or lives of persons in existence at the time when the settlement takes effect, and twenty-one years more.

LANDS IN GAVELKIND and BOROUGH ENGLISH are an exception to the general rule of law as to the descent of land.

The law of primogeniture, then, only operates in the cases already explained; and the system of settlements by which property is kept together in large masses is quite distinct in principle from the law of primogeniture. It is not the result of a law which favours primogeniture, but it is the result of the legal power which an owner of land has over it, and of the habits of the people. The various reasons which have laid the foundation of this habit, and which perpetuate it, are foreign to the consideration of primogeniture as a rule of law.

In the United States, after the Revolution, an Act was passed for converting estates tail into fee-simple, and at the same time the law of primogeniture was abolished as being contrary to the spirit of American institutions. These laws have so far been in accordance with or have acted on public opinion, that a parent by his will now generally makes the same disposition of his property as the law makes in case he dies intestate. On the Continent primogeniture, except in the succession to the crown, has been generally abolished by the various civil codes which have superseded feudalism.

PRIMROSE (*Primula*) is a genus of plants belonging to the order PRIMULACEÆ. The species are perennial herbs, natives chiefly of the temperate parts of Europe and Asia, with leaves usually in radical clusters, and flowers solitary or in simple umbels. The calyx is bell-shaped or tubular, five-toothed, the corolla salver-shaped, with the limb divided into five lobes, the stamens five in number, each opposite to one of the lobes of the corolla, the ovary superior, one-celled, with many ovules attached to a free

central placenta. In most of the species of *Primula* the flowers even on the same plant present a variation in the length of the stamens and styles. In some the stamens are inserted at the throat of the corolla-tube, and the stigma only reaches half-way up the tube; in others the stamens are inserted half-way down, and the style is so long as to reach to the top of the tube. The former are called by gardeners "thrum-eyed," the latter "pin-eyed." This dimorphism has been shown by Darwin to be connected with cross-fertilization. An insect, visiting in search of honey a long-styled flower, would brush off some of the pollen at that part of its proboscis which would come into contact with the stigma if it visited next a flower having a short style. Conversely the pollen from flowers in which the anthers protrude from the throat of the corolla-tube is transferred to the stigmas of long-styled flowers. Darwin has shown that more seeds are produced, and that they give rise to healthier plants, if this cross-fertilization be secured than if the flower be fertilized by pollen taken from a flower of the same form. The species of *Primula* are remarkable for their beauty, and many are cultivated in gardens.

The Common Primrose (*Primula vulgaris*) abounds in woods, thickets, and hedge-banks in Britain, and is one of the earliest of our spring flowers. It has oblong, ovate, wrinkled radical leaves, between which arise flowering stems or scapes, each bearing a single yellowish-white flower. The Cowslip or Paigle (*Primula veris*), common in meadows and pastures, is distinguished by the scapes bearing umbels of flowers, and by its calyx being bell-shaped instead of tubular. Its flowers possess well-marked sedative and diaphoretic properties, and make a pleasant soporific wine. The Oxlip (*Primula elatior*), found in woods and meadows in the eastern counties, has also its flowers in umbels. The true oxlip is a rare plant, that called by this name being a hybrid between the common primrose and the cowslip. The Bird's-eye Primrose (*Primula farinosa*), found in Wales, the north of England, and the south of Scotland, has pale lilac flowers with a yellow centre. *Primula scotica*, with bluish-purple flower, yellow at the centre, is found in Britain only on sandy heaths in the extreme north of Scotland. Both these latter species are also found in Arctic latitudes.

The Polyanthus of gardens is a variety of the cowslip produced by cultivation, bearing flowers of great beauty. The garden Auricula, at one time considered to be a variety of an Alpine species, *Primula auricula*, is now thought to be derived from a hybrid between that species and *Primula hirsuta*. The Chinese primrose, producing numerous lilac or white flowers in compound umbels, is a favourite garden plant; it is derived from *Primula pinnatifida*. The Japanese Primrose (*Primula japonica*), introduced of late years into our gardens, is another species of great beauty. Several species from the Himalayas are also cultivated.

The old English name of the primrose, *princewote*, was originally applied to the daisy.

PRIM'ULA. See PRIMROSE.

PRIMULA'CEÆ is an order of plants belonging to the group GAMOPETALÆ. About 250 species are known, chiefly from the temperate regions of Europe and Asia, a few being alpine; in the southern hemisphere the species are rare, but a few are found even between the tropics. They are herbs with usually an underground rhizome, radical exstipulate leaves, and regular, hermaphrodite flowers on solitary or umbellate scapes. The calyx is free, tubular, four to nine cleft, persistent; the corolla is usually gamopetalous, with the limb four to nine partite, wheel-shaped, salver-shaped, bell-shaped, or funnel-shaped; the stamens, equal in number, are opposite to the lobes of the corolla, and are situated on its tube or throat; the ovary is free, one-celled, with a simple style, and free central placenta. The fruit is a one-celled capsule.

The Primulaceæ are remarkable rather for their beauty than for any useful properties which they exhibit. The roots of many contain an acrid principle, of others a bitter resinous substance; in some the leaves are astringent. Many well-known garden flowers belong to this order, as the primrose, cowslip, auricula, and other species of the genus *Primula* [see PRIMROSE]; and the cyclamen; other British plants of the order are the Pimpernel (*Amgallia*), the Brookweed (*Samolus*), and the Loosestripe (*Lysimachia*).

PRINCE is the Latin word *princeps*, which was originally used to denote the person who was entitled *Princeps Senatûs* in the Roman state. He seems to have been originally the *custos* of the city, and his office was one of importance. Subsequently it became a title of dignity, and the princeps was named by the censors. (Liv. xxvii. 2.) Augustus adopted the title of princeps, as a name that carried no odium with it, and this became henceforward the title of the master of the Roman world. The word prince is applied to persons who have personal pre-eminence, and especially to certain sovereigns of small states who possess sovereign power; others possess the title without sovereign power or anything that distinguishes them politically from other nobles or persons who enjoy privileges. But the word seems not to have acquired so definite a sense as that which belongs to king, duke, marquis, earl, and some others of the class; but rather to denote persons of high rank in certain states, as in Prussia, Russia, Italy, and other continental states, or persons who are junior members of sovereign houses.

In England it has sometimes been the practice of the heralds to speak of a duke as "the high and mighty prince;" but the word now seems rather to be restricted among us in its application to persons who are of the blood-royal, that is, a son, grandson, or nephew of a king; and it would probably be extended to the remote male posterity of such persons, though no case has arisen in the course of the last three centuries. But in its application it is merely a term of common language, not being conferred, like the title of duke, in any formal manner; and even the precedence which is given to blood-royal has respect to birth, and not to the enjoyment of this word as a title of honour. The eldest son of the king, or queen regnant is made Prince of Wales by creation. The younger sons are princes until they have other titles conferred upon them.

PRINCE EDWARD ISLAND, a province of Canada on the coast of North America, in the Gulf of St. Lawrence, situated between 43° 48' and 47° 7' N. lat., and between 62° and 64° 27' W. lon. It extends from east to west in a somewhat curved line 135 miles in length. The width varies between 3.4 miles and 4 miles. The area is 2133 square miles. It is separated from Nova Scotia and New Brunswick by Northumberland Strait, which in the narrowest part is hardly more than 10 miles wide.

The coast is so intersected by bays and creeks, that there is hardly a place which is more than 8 miles from the shore. The most remarkable of these bays, all of which form good harbours, is that of Hillsboro, which enters the island from the south with a broad opening, but afterwards becomes so narrow that it appears like a river, and is called Hillsboro River: the tide ascends nearly to its extremity, 20 miles above Charlotte Town. The surface of the island consists of gentle undulations; it is well watered, and the soil is very productive. The climate is favourably distinguished from that of the surrounding countries by being exempted from fogs and being much less subject to cold; altogether it is extremely healthy and agreeable. In summer the weather is warmer than in England, and in winter it is colder; though it is not so warm as in Italy in the former season, nor so cold as in Sweden and Norway in the latter. Timber is plentiful, the trees being principally pine, spruce-fir, hemlock, beech, birch, maple, poplar, and

white cedar. Soil and climate unite to make this island an agricultural country, the pastures especially being of a superior quality. All kinds of grain and vegetables grown in England, and many of the fruits, thrive very well. The horses are small but hardy. The black cattle are of a smaller size than in England. Sheep and swine are plentiful, and the breed of the former has been much improved. The wild animals are bears (which, however, have been nearly exterminated), loup-cerviers, foxes, hares, otters, martens, musquashes, minks, squirrels, musk-rats, and weasels. Seals are found in the bays and along the shores in summer and autumn; and in the former season immense numbers sometimes come down on the ice from the northward. Among the birds the partridges are distinguished by their size, and wild pigeons abound. Fish of all kinds are plentiful, and the oysters are considered the finest in America. Many cargoes are annually sent to Quebec and Halifax. The fisheries altogether employ 200 or 300 vessels in summer, mostly from the United States.

The island is entirely composed of carboniferous sandstone; and coal is abundant, but there are no other valuable minerals.

The inhabitants of the colony consist chiefly of Scotch and English immigrants and their descendants, and a few Acadians, or Americans of French origin. Rather more than one-half are Protestants, the remainder Catholics. The population in 1850 was 62,499; in 1871 it had increased to 93,521, and in 1881 it was 108,091. Prince Edward Island is by far the most thickly populated of the North American colonies.

With the exception of between 2000 and 3000 acres, the whole of the crown lands in this colony were in 1767 divided by lot among sixty-seven persons, in lots of about 20,000 acres each. The grantees were either officers of an expeditionary force sent to the island or court favourites of the period. Coupled with the grants were various conditions, the non-fulfilment of which was, by the grant, to cause a forfeiture or escheat of the lands to the crown. Some of these conditions were of a peculiar character—as, for example, that of settling the country with a certain number of foreign Protestants. Complete failure attended this scheme. Various steps were taken at different times to remedy the evils arising from the method of grant, but without much success, until, in 1875, an Act was passed providing for the compulsory purchase of the land by the government. It was almost immediately brought into operation, and the whole of the large proprietors bought out. In many cases the land was resold to the tenant at a loss.

The commerce of the island consists in the exchange of its agricultural produce, timber, deals, ships built, and fish, for British manufactures, spirits, and other articles of domestic consumption. From the custom-house returns of the colony, it would appear that the island imports about the half of its requirements from the United Kingdom, and exports more than half of its products to this country and to France. Shipbuilding is an important and increasing branch of industry.

A railway across the island was completed in 1875. It was a line, or system of lines, 290 miles in extent. The assumption of this railway by Canada was one of the chief means of bringing the island into the Dominion, as it did not seem likely to pay as a speculation. The island is also traversed by good roads. It is divided into three counties—King's, Queen's, and Prince's County. The chief places are Charlotte Town (the capital), George Town, and Prince Town. In 1856 free schools were established all over the island. The Bible is read daily in the schools, but without note or comment, and the children whose parents object are exempt from attendance during the reading. The English law is administered by a chief justice, and there are besides district courts.

Charlotte Town, the capital and seat of government,

in Queen's County, is situated on the north side of Hillsboro River, near its confluence with the rivers Elliot and York. It is on the south coast of the island, and has a good harbour, which, indeed, is considered one of the best in the Gulf of St. Lawrence. The town stands on gently rising ground, and is regularly built, with broad streets intersecting each other at right angles. Its principal buildings are—the Episcopal and Scotch churches, the chapels, the court-house, the barracks, the fort, and the Prince of Wales' College, founded in 1860, the principal educational establishment in the island. The population in 1881 was 11,485. Shipbuilding employs a large number, and in the town are also an iron foundry and a coarse woollen factory.

Prince Edward Island was discovered by Cabot in 1497. It was taken possession of by the French after the settlement of Canada. In 1758 it was taken by the English, and has ever since belonged to Great Britain. It was separated from Cape Breton and constituted an independent colony in 1768, when it was known as St. John. It derives its present name from Prince Edward, duke of Kent, one of the sons of George III., who took much interest in it. In 1866 it declined, by a majority of twenty-one to seven, to be incorporated in the Canadian Confederation; but material considerations at length prevailed over sentimental ones, and in 1873 it agreed to the union on condition, among others, of receiving 800,000 dollars to be paid by Canada for the purpose of purchasing the proprietors' estates, as previously described.

PRINCE OF WALES ISLAND. See PENANG.

PRINCE RUPERT'S DROPS. Prince Rupert, the nephew of Charles I. of England, and one of his generals in the Civil War, was something of a physicist and inventor. The alloy of zinc and copper called pinchbeck is with fair show of reason set down to him; and so is the curious philosophical toy which is the subject of this article. If Prince Rupert did not discover them, he at any rate introduced them into England.

Prince Rupert's Drops are made by pouring melted glass into water, so that it separates into drops. Now, these drops have their external surface cooled almost instantly, and this is, therefore, thrown into a great state of strain from the contraction of the interior, which cools more slowly. The drop is usually in the form of an ellipsoid or pear-shaped body, with a fine stalk at the small end ending in a point, and this shape gives them the alternative name of "Dutch Tears" (in French, *Larmes Bataviques*). The form described is so well adapted to resist strain that it holds good against it so long as the drop is intact; but let the stalk be broken, or let even a scratch with a glazier's diamond be made on the surface of the drop, and the molecular balance is overthrown, the intense strain is irresistible, and the drop falls into fine dust. Delicate instruments show this molecular motion to be accompanied with a not inconsiderable amount of heat.

PRINCE WILLIAM SOUND is a wide bay on the N.W. coast of North America, extending with several branches between 60° and 61° N. lat., and between 146° and 148° 30' W. lon. It opens to the south, and the entrance contains two large islands, of which the eastern is called Rose Island, and the western Montague Island. There are no good harbours; Rose Island contains Port Etches, where the Russians had a factory, and a wooden fort, called Fort Constantine. The islands are rocky and mountainous. The country contains pine, alder, and hazel trees, and strawberries, raspberries, and alderberries. Sea-otters and foxes are met with, and other fur-bearing animals are abundant in the forests. The natives, who are few in number, and called Oogahikmutes, live mostly on the produce of their fishing. They seem to be a cross between the Eskimos and the other Indians.

PRINCEPS, EDITIO, the first printed edition of a medieval or classic work.

PRINTING is one of the arts which have done most for the prosperity of the human race. It lies at the bottom of the refined and comprehensive civilization of the Western races. It may seem strange that any doubt should prevail as to who was the inventor of printing, but with most great inventions a similar difficulty exists. They would appear to be not the unaided effort of the labour and ingenuity of one active mind, but the accumulated results of many minds contemporaneously but independently working towards one end. These results are finally embodied in a practical form by some fortunate genius, whom posterity is generally content to reward with the glory that should be shared among his predecessors. Watt invented the steam-engine; that is, he made practicable the ideas of Savary, Denis Papin, and Newcomen. Gutenberg invented printing; that is, he carried out the cruder ingenuity of Laurens Coster and others.

The invention of printing took place early in the fifteenth century; but the principles on which it was founded were known to the fathers of civilization, the ancient Assyrians. Among the ruins of Babylon have been discovered entire bricks stamped with symbolic figures and hieroglyphic characters. It should be observed, however, that in this, as in all similar relics of antiquity, the figures were impressed by one block or piece, which was only available for a single subject. Printing letterpress from engraved blocks of wood, though not from movable type, has been practised in China for nearly 2000 years. A similar mode of printing playing-cards and rude scriptural illustrations was in vogue in Europe about the middle of the fourteenth century. It is evident, however, that printing, in this fashion and of this limited kind, could never have been made available in any extensive degree for the diffusion of knowledge. The great discovery in printing, which rendered it so important an agency in the work of civilization, was that of *movable types*; of forming each alphabetical character *separately*, so that it could be used in countless combinations, the same types being employed in "setting up" successive pages. It was this discovery which rendered *cheap books* possible. Previously their enormous cost had entirely confined them to the libraries of the wealthy. In 1272 the pay of a labourer was 1*d.* per day. At that time the price of a Bible, "fairly written," was 50 marks, or £33, a sum equal to £660 at the present value of money. At a later period the price of a single book of *Livy* was 120 crowns of gold; and the folio MS. of the "*Roman de la Rose*" cost 40 crowns, or about £33 10*s.* sterling.

About 1423 one Laurens Janszoon Coster, of Haarlem, printed with blocks a book of images and letters, called "*Speculum Humane Salvationis*," for which he employed an ink more tenacious and viscous than common ink. The leaves of this book were printed on one side only, and afterwards pasted together. A few years afterwards John Gutenberg, of Mainz, entered into partnership with an opulent goldsmith named John Faust or Fust, and, after numerous experiments, printed the first book from *cut* or movable metal types—namely, an edition of the *Vulgate Bible*, which was begun about 1450 and completed in 1460. In 1452 Peter Schöffer, son-in-law of Faust, cast the first metal types in matrices, and was therefore the actual inventor of complete printing. Cast-metal types, according to some authorities, were first used for a second edition of the Mainz Bible.

These were the *principia*, the beginnings of the art. The partnership between Gutenberg and Faust was soon dissolved; and the former being unable to repay part of the capital advanced by the latter, the whole of the printing apparatus fell into the hands of Faust, who printed off a considerable number of copies of the Bible, to imitate those which were commonly sold as MS., and undertook the sale of them at Paris. It was his interest to conceal this discovery, and to pass off his printed copies for MS. "But,"

says D'Israeli, "enabled to sell his Bibles at 60 crowns, while the other scribes demanded 500, this raised universal astonishment, and still more when he produced copies as fast as they were wanted, and even lowered his price. The uniformity of the copies increased the wonder. He was denounced as a magician. The peculiarly brilliant red ink which embellished his work was said to be his blood; and it was seriously asserted that he had sold himself to the Evil One. Faust, to save himself from a bonfire, was compelled to reveal his art to the *parlement* of Paris, by whom he was discharged from further prosecution, in consideration of the wonderful nature of his invention."

Faust now took into partnership his son-in-law Schöffer, and the two commenced printing from cast-metal types. In 1457 they issued an edition of the *Psalter*; and in this, says Hallam, the invention was announced to the world in a boasting colophon, though certainly not unreasonably bold. In 1465 they published an edition of Cicero's "*De Officiis*," the first tribute of the new art to polite literature. Two pupils of their school, Sweynheym and Pannartz, migrated the same year into Italy, and printed Donatus' grammar and the works of Lactantius at the monastery of Subiaco, in the neighbourhood of Rome. Venice had the honour of bestowing her patronage on John of Spira, the first who applied the art on an extensive scale to the publication of classical writers. Several Latin authors came forth from his press in 1470; and during the next ten years a multitude of editions were published in various parts of Italy, Germany, and France. The art reached Paris in 1469, England in 1474, and Spain in 1475. Its introduction was coeval with a remarkable intellectual movement in Europe. The days of feudalism had passed. Through all Christendom the old order was dying out, and men were eagerly watching for the dawn of a great revolution. The ground was athirst, and readily drank up the blessed waters that flowed from fountains so opportunely opened. Santander, in his elaborate "*Dictionnaire Bibliographique*," supplies a list of 200 places where printing was already practised before the close of the fifteenth century, with the names of the printers and the first productions of their presses.

The types first employed were all in the Gothic or Old German (now known as the black letter) character, and Greek was not used until 1465, in an edition of Cicero's "*Offices*," where it is so imperfect as to be scarcely decipherable. The first book wholly printed with Greek types was a Greek grammar written by the learned Constantine Lascaris, and issued at Milan by Dionysius Paravisinus, in 1476. A far finer specimen of typography, however, was the first edition (1500) of the "*Argonautica*." The first Greek book printed at Cambridge was Plato's "*Menexenus*," in 1515. The first book in which the Roman type was used was Cicero's "*Epistolæ ad Familiares*," not inappropriately printed at Rome (1467), by Sweynheym and Pannartz. Aldus Manutius invented *italic type* at Venice, about 1500. Hebrew characters were introduced at Soncino, in the Milanese, in 1488, by two Jewish rabbis, named Joshua and Moses, who issued a Hebrew version of the Old Testament. Towards the close of the sixteenth century various Oriental types were introduced by active and enterprising printers.

The father of the English printers was the ingenious William Caxton, who, in or about the year 1474, established a printing-press near the Sanctuary, Westminster, in an old chapel of the famous abbey. There, having learned the art abroad, he was occupied for many years as a printer, and also as an author, translating and editing books on a great variety of topics. Sixty-four works in all are said to have issued from his press. He employed Gothic characters, mixed with a kind of written hand; and instead of commas or periods, an oblique stroke, thus / . He used no signatures, and never numbered his pages. His devices

consisted of W. C. and 74, the year in which he introduced his art into England. See CAXTON.

His pupils and followers were John Letton, Theodoro Rood, William Machilliana, and Wynkyn de Worde, foreigners, and Thomas Hunt, an Englishman. Wynkyn de Worde was the first printer in England who made use of the Roman letter. All his works—and they number 410—are distinguished by their typographical excellence.

For the first sixty or seventy years all copies of the Scriptures reproduced by the new art were printed in Latin or Greek. The first English version printed was that of Tindal and Coverdale; it appeared at Antwerp, in 1526, but the whole impression was bought up and burnt by Cardinal Wolsey's orders. The first complete English translation printed by authority was Tindal's version, corrected by Coverdale, and examined by Archbishop Cramer. It was called Cramer's Bible, and was printed by Grafton and Whitchurch (1539-44).

It is a remarkable characteristic of the English printers that, while their continental brethren in the art were confining their efforts to the reproduction of the ancient classics, they issued works in their own native tongue, and so contributed to its development and perfection. They were chiefly patronized by the English nobles, who eagerly bought their versions of ancient authors, of devout books, French and Italian romances, and mediæval chronicles. A list of the works printed in England between 1550 and 1600 would throw a vivid and interesting light on the tastes and intellectual tendencies of the English higher classes. The love of knowledge soon spread to the commonality, and a great demand arose for educational works, for chronicles, romances, and ballads, and for the writings of native poets, so that no less than 350 printers flourished during the sixteenth century in England and Scotland, who, in the same period, published between 8000 and 9000 distinct works.

The Civil War temporarily checked the progress of the art, nor was the licentious reign of Charles II. calculated to favour its growth. An Act of Parliament actually existed limiting the number of printers to twenty-nine; these were hampered with severe legal restrictions, and compelled to obtain the licenser's authority before they could issue the most trivial broadsheet. Literature, consequently, was almost wholly confined to the metropolis or its immediate neighbourhood. Only such flimsy works as could be carried by the postboy reached country divines and country justices. Provincial printing-presses were "conspicuous by their absence." The parsonage was scantily furnished with books, and the houses of the gentry could scarcely boast of a much better supply. The whole number of books printed between 1666 and 1680 was only 3550, or at an annual average of 253. If we deduct from these reprints, sermons, pamphlets, and maps we may conclude that the yearly product of new works did not exceed eighty.

The great French Revolution which, towards the close of the eighteenth century, lent so extraordinary an impulse to thought upon the Continent, extended its quickening and enlivening influences to the British Isles. One of its consequences was a remarkable increase in the number of new books issued annually. There were more men with something to say, than in less active times, and more men willing and anxious to hear. In fact, popular literature dates from this epoch. We hear no more of the rich or titled patron. Authors had learned to address themselves to the public, and obtained from the public a surer and more liberal reward than from even such enlightened judges as Dorset or Halifax. From 1792 to 1802, or in a period of eleven years, 4096 new works were published, exclusive of pamphlets, and of course of reprints. These figures give a yearly average of 372, or four times the previous yearly amount. From this time there was no let or hindrance to the onward course of the printer. He soon became the agent of the political news-gatherer, and the *Times* and

other daily journals were soon broadcast over the land. A further step was made in 1832, when the publication of the *Penny Magazine* inaugurated a new era, the era of books for the million. The extraordinary growth of the power and love of reading in our own country is best shown by the fact that while in 1824 there were only 266 newspapers in the United Kingdom, there existed no less than 2093 in 1886.

The printing-press, through the skill and labour of ingenious inventors, has kept pace with the popular demand. The penny newspaper is enabled to throw off its 47,000 impressions per hour, so that metropolitan news of the previous day can now be read in less than twenty-four hours afterwards at John o' Groat's House or Land's End, and the public of to-day think it quite a natural thing that they should be offered large and copiously illustrated copies of standard works for the sum of 6d.

Putting aside the elaborate productions of the great printers, our ancestors had no works worthy of comparison with those of the present day for typographical excellence, and the shilling volumes now are better "got up" than the half-guinea and guinea volumes which formed the libraries of a Sir Roger de Coverley or a Parson Adams. Our English and Scotch printers in many branches of their art surpass the continental, while fifty years since they could not even approach them. Illustrated books have become a feature in our current literature. Their number, their cheapness, their merit, would alike excite the wonder and astonishment of our forefathers. Colour-printing, moreover, has attained to a wonderful degree of excellence, though it can scarcely be said to have existed as an art until Mr. Savage, in 1819-22, published his "Hints on Colour-printing." Mr. George Baxter, in 1836, produced some excellent specimens, in some of which he employed twenty different blocks. It was afterwards applied to LITHOGRAPHY, under the name of chromo-lithography, which has been developed to a remarkably successful extent. Mr. A. C. Leighton, in 1851, commenced colour-printing by machinery, and has since been followed by a crowd of colour-printers. In this process a separate "printing" is usually required for each distinct colour; thus if a picture were required which contained, say black (outline), red, blue, yellow, brown, and gray, the sheet would have to pass through the machine six separate times, the order probably being, first black (outline), second yellow, third red, fourth blue, fifth gray (for shadows), sixth brown (for shadows). If a limited amount of green, orange, or purple were required in the picture this could likely be attained without separate printings by using transparent ink and printing one of the primary colours on the top of another, but as a rule all colours which play an important part require a separate printing. The actual process of printing is similar to working with black ink, but coloured inks require greater skill and taste in manipulation, and each colour must fit into its place with the most perfect exactness. It is hardly possible for a non-practical person to estimate the number of printings a coloured plate has received, and few of our readers would guess that many of the coloured illustrations of this Encyclopædia have passed through the machine more than a dozen times.

Scotland and Ireland.—The art was introduced into Edinburgh about thirty years after Caxton established his printing-press in Westminster Abbey. James IV., by patent, authorized Walter Chapman and Andrew Mollar to print books, in 1507, and the first work issued is said to have been "The Proteus of Nobleness." Glasgow has also long been favourably known for its superior typography. Both cities are noted for their typographers, and issue works not unworthy of comparison with the best produced by London printers. In Ireland the art was unknown until 1551, and it made but little progress until the eighteenth century.

The Continent.—The French printers have always ranked foremost among the brotherhood of Gutenberg and Schöffer. The presses of Paris produce work of surpassing merit, and at Tours, Orleans, and other provincial towns large establishments are successfully conducted. In Germany the progress of the art was long hindered from political causes; but it would now be almost impossible to award the palm of excellence to any one country, so perfect are the great establishments in every capital. The German press is well worthy to print the writings of her great philosophers and poets, and the famous book fairs of Leipzig attract purchasers from every part of Europe. At Vienna the Imperial Printing Office has been developed into an establishment of the highest importance, which is famous for its vast collection of ancient and Oriental types, and both Austria and Italy have produced chromo-lithographs which are of the highest artistic merit, and simply faultless technically.

The first press in the American colonies was established at Cambridge, Massachusetts, in 1638, and the New World can now hold its own, if not surpass, the Old both in quality and speed of production.

TECHNICAL DESCRIPTION.

There are three main branches of the art of printing:—

1. From raised surfaces, such as types or woodcuts, usually called *letterpress printing*.
2. From the flat surface, usually called *lithography*, as lithographic stone is chiefly used in this process.
3. From an intaglio engraving, usually called *copperplate printing*, as copper (or steel) plates are chiefly used in this process.

Colour-printing or *chromo-printing* simply means that coloured ink is used instead of black, and *oleography* is a development of colour-printing in which the coloured prints when finished are roughened, varnished, and mounted on curvius, so as to look like oil-paintings.

Apart from these technical and radical differences, printing firms tend to adopt certain specialties as their own; thus as well as letterpress printers, lithographers, and copperplate printers, some firms are known as chiefly doing newspaper printing (a very rough class of work), others as doing job printing, and others again as doing book-work, the highest branch of the trade. Colour-printing, again, is most successfully cultivated by specialists, usually lithographers, although colour-work of the highest class is also done from the raised surface.

This article is chiefly concerned with the first of the three above main branches, for the second is explained in the article LITHOGRAPHY, and much information about the third will be found in the article ENGRAVING.

In letterpress printing two special classes of workmen are employed, viz. *compositors*, who "set up" or arrange the types into lines and pages, according to the MS. furnished by the author (technically called "copy"); and *printers* (pressmen or machine-men), who work off the impressions upon paper. In addition to these, however, numerous other branches of industry have been introduced, more or less requisite, according to the class and extent of work carried on. We will now give a brief technical description of these, beginning with that of the compositor.

Type.—The types employed differ greatly in size according as they are intended for *job-printing* or *book-printing*, the former including such work as hand-bills, posters, &c., and only limited in variety by the taste of the type-founder. Book types include fourteen regular bodies or founts, from *Great Primer*, which is the largest, to *Brilliant*, the smallest type used for printing books, as follows:—*Great Primer*, *English*, *Pica*, *Small Pica*, *Long Primer*, *Bourgeois*, *Brevier*, *Minion*, *Emerald*, *Nonpareil*, *Ruby*, *Pearl*, *Diamond*, and *Brilliant*. There are in addition numerous other sizes, called "bastard" founts, which bear the face of one fount on the body of another, such as *Bourgeois* on *Long Primer*,

and called *Long Primer Bourgeois*. *Pica* forms the standard of measurement adopted for the various materials used by compositors, such as leads, furniture, &c., all other founts also bearing a certain proportion to it. See *TYPE*.

Composition.—The compositor stands before a "frame," projecting from the wall at a convenient angle, on which are placed two cases filled with type, technically known as an *upper* and a *lower* case. Each case is divided into small compartments or *boxes*, one for every letter or character: the upper, with ninety-eight boxes, contains the *capital* and *small capital* letters, accents, and such characters as are least often wanted; the lower, with fifty-three boxes, which are of four different sizes, comprehends the small letters, figures, points, spaces, quadrats, &c. The letters most frequently used are placed nearest to the compositor's hand, and in the greatest abundance; these are a, r, t, u, m, n, h, o, p, c, d, e, i, and s. The *spaces*, which

	'	k	g		1	2	3	4	5	6	7	8
z	b	c	d	e	i	a	f	w	o			
j												
y	l	m	n	h	o	p	.	spaces	d	m	spaces	spaces
q	v	u	t	spaces	a	r	.	quad.				
x												

Diagram of Lower Case.

are simply *shanks* of letters without faces, cast one-fourth lower than the body, are required to separate one word from another; they all bear a certain proportion to each other. *Italic* letters are retained in separate cases.

Having received instructions as to the type he must use, the width of the page, and other details, the compositor places his copy on the front of the upper case before him, and takes in his left hand an instrument called a *composing stick*, usually made of iron, and resembling a small frame, capable, by means of a screw and a movable slide, of being adjusted to the different widths employed in printing. As soon as he has screwed up his stick to the proper width, he lays in it a *setting rule*, or smooth piece of brass, which is of the same width as the measure, and as high as the type, and proceeds to pick up his letters, spaces, and points, one by one, with a quickness that depends upon his skill and experience. A good compositor will "set up" about 2000 types in an hour. He looks not at the face of his types, as he concludes each will be in its appropriate box, but glances rapidly at a *nick* cast on the under side of each type, which he places with the nick outside of his rule. He secures each letter with the thumb of the left hand, placing the types side by side in a line from left to right. When he has come to the end of his setting rule, he knows he has finished a line. But it may happen that the line ends in the middle of a syllable, thus:—

Where it is indigenous, and which by Europeans is thoug

Now he must either get into the line the whole of the word "thought," or must "space out" the preceding words so as to complete the line without it. This is called "justification," and is a difficult process. To secure uniformity of appearance, one word must not be too far apart from another, or too close to it. Either fault, as the following example shows, would injure the look of the page:—

Where it is indigenous, and which by Europeans is

The compositor therefore has to arrange his "spaces" in such a manner as to please the eye of the reader, and preserve a uniformity of distance between every word. It is in this part of his work that the taste and skill of a good workman are peculiarly apparent, in giving his composed matter a uniform appearance, neither too white nor too dark.

Line after line is thus set up and justified, until the composing stick is full, when the compositor clasps the mass of metal by the rule and between the thumbs and first and second fingers of both hands, and deposits it upon an oblong tray, usually of brass or zinc, with half-inch edges round the top and sides, called a *galley*. When full the galley is laid upon the press, and a first impression taken or pulled, which is called the "first proof." This is revised and corrected by a "reader" while a "reading boy" reads aloud the author's copy. As soon as this is done the proof is handed to the compositor, who picks out the wrong types with a sharp awl or "bodkin," and inserts right ones. Then another impression is taken, which, after further examination, is forwarded to the author, who in his turn makes what alterations he thinks necessary, and returns it to be printed. In Plate I. we give an illustration of a proof as marked for correction by the reader, with explanations.

When a considerable amount of corrected matter has thus been collected in galleys the compositor proceeds to divide it into pages and sheets, with proper headlines, folios, and signatures, and binds each page round securely with cord. This done, he lays them down on the *imposing stone*—which is generally a flat block of iron or marble mounted on a strong wooden framework—and "imposes" them. This operation consists in placing the pages in such a position that, when printed and folded, each page will succeed in its proper order. He then takes a rectangular frame of iron, called a *chesse*—of the size of the paper about to be used, and having two iron transverse bars, called a long and a short cross—which is placed round the pages. Now, between the chesse and the various pages a space intervenes. This space the compositor proceeds to "dress" or fill up with pieces of "furniture," which are simply slips of wood or metal of different thicknesses, placed, some at the head ("head sticks"), some between the pages ("gutters"), and some at the sides and bottom ("side" and "foot sticks"). These he wedges together by small wooden "quoins" into a perfectly firm and solid mass or "forme." A forme of this Encyclopædia, which is set up in brier type, contains sixteen pages, and about 117,000 separate letters and spaces. In all standard works, instead of being printed from the types, each page is put separately into a small frame the size of the page and stereotyped. By this process a *fac-simile* of the page is taken by casting, and the type can then be taken down and so be again ready for setting up.

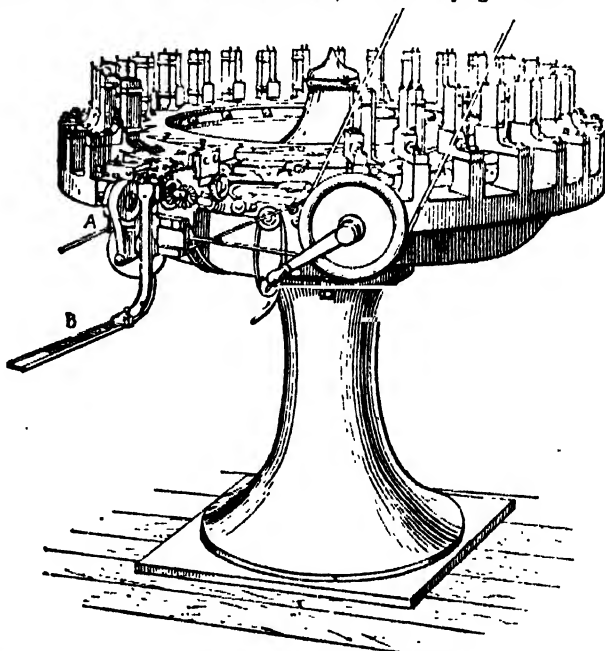
In addition to a thorough knowledge of the numerous peculiarities pertaining to book-work, the compositor's art necessarily requires considerable readiness in comprehending the subject on which he is engaged, together with the exercise of skill and good taste in the display of general job-work—combining dexterity with precision and accuracy.

Distribution.—The compositor's work is not finished when the pages which he has helped to "set up" are sent to the press. As soon as the required number of impressions has been taken, or the forme stereotyped [see STEREOTYPING], it is returned to the compositor, who has next to "distribute" the letters into the various boxes of his cases before they can be again used for fresh matter.

Type-composing and Distributing Machines.—Numerous attempts have been made to increase the manipulative power of the compositor in type-setting by the aid of machinery. Most of these machines have been based on the principle of selecting and liberating each letter by depressing a corresponding key on a key-board, similar to the

clavier of a pianoforte. Some of these machines operate only on the *lower-case* letters, while others include the capital letters. The greatest technical difficulty which these machines encounter is the spacing of the lines. They can easily be contrived to set up words with great rapidity, but these words vary in size, and yet they must be arranged in lines of exactly equal length; this is done by varying the distances (spacing) between the words; but the whole line must be set up before it can be ascertained how much space must be left between each word, i.e. before the line can be "spaced," and the difficulty lies in getting the machine to go back over its work to do this. In fact more than one inventor has given this up as hopeless, and called in the aid of manual labour after the mere words have been set up in a row. Yet when the setting and spacing are accomplished only half of the compositor's work is done, for when a page has been printed or stereotyped the letters must be "distributed"—rearranged in boxes, each kind of letter by itself, consequently a second machine is required to accomplish this task, which presents still greater difficulties than type-setting; so great indeed are they that in some offices using these machines the Gordian knot has been cut by throwing the whole page into the melting-pot and actually *re-casting* the individual letters out of the molten metal.

A vast amount of ingenuity has been displayed in inventing machines of this class, but with varying success. As an



Dr. Mackie's Type-composing Machine.

example, we will describe the invention of Dr. Mackie of the *Warrington Guardian*, a paper which has been set for over fifteen years by this machine, with a saving stated at over 50 per cent. Dr. Mackie's steam type-composing machine may be said to consist of two principal parts, namely, the type-setting machine proper, and the small perforating machine by which are prepared the strips of paper which govern the action of the type-setting machine. The strips used are about 2 inches wide, and are perforated with a continuous row of equidistant holes down the centre. These holes are, as it were, geared into by teeth or pins fixed in the periphery of a wheel on the composing machine, and the paper strips are thus fed forward at a regular rate. On

each side of this central row of holes are eight other rows, these rows, however, not being continuous like the central one; but such perforations as they contain are always in a line with a perforation in the central row. If a strip of the perforated paper be taken, and lines ruled across it through the centres of the perforations in the middle row, it will be found that of the eight rows on one side of the letter there are never more than two perforated simultaneously, whilst in the eight rows on the other side of the centre there may be perforations in the whole or any less number of rows. The perforating of the paper is effected by a small apparatus with sixteen keys, and it is said that the perforations can be made at the average rate of 16,000 letters per hour.

The composing machine consists of a circular table or framing mounted on a central standard, as shown in the illustration (opposite page), and carrying on brackets around its periphery a series of twenty-nine boxes or "pockets," each divided into eight divisions. In the divisions of each pocket are stored seven varieties of letters, while the eighth division is devoted to spaces. The divisions of the pockets are furnished with slight lips at the bottom, so that the type contained in them cannot fall out, space, however, being at the same time left between the lips for the action of the pins of the "pickpockets," of which we shall speak presently. Within the circle of the "pockets," and at a slightly lower level, there revolves a wheel carrying with it, arranged around its periphery, a series of what are called "pickpockets," each having what we may term a receiving table, pierced with eight holes through which pins may be made to rise. Each table can be raised into a horizontal position, in which it will pass close under the pockets, and when so raised any of the pins already mentioned draw out a type from that division of the pocket to which it corresponds. The types thus drawn out fall on the receiving table, and the latter, becoming depressed again after leaving the pocket, carries them round to the point of delivery. The "pickpockets" are made to call at the proper pockets to take out the letters required by the perforated paper, which is unwound from a drum, and passes over a small wheel, this wheel having an intermittent motion, and carrying the paper forward by means of the teeth. The types are taken from the pockets by means of triggers, which drop into the holes in the perforated paper, and by so doing assume positions which enable them to operate upon certain parts connected with the next pick-pocket which passes over them. The effect of the triggers falling into the holes is so to adjust parts connecting with the pick-pocket brought under their influence that when, in the course of its circuit, that pick-pocket arrives at a certain pocket, its receiving table rises up into a horizontal position, and the pins, projecting up through it, draw type out of the corresponding divisions of the pocket.

Composing complete words at one operation is also one of the leading features of Dr. Mackie's ingenious apparatus. By arranging the letters in the pockets in certain orders he has been enabled to produce a series of combinations by the aid of which he is able to withdraw from the pockets, each at a single operation, about 700 words or parts of words.

The type lying on the receiving tables of the pickpockets, as it approaches the point of delivery, rises into a horizontal position, so that it is brought on a level with a bell-mouthed channel, along which the type are delivered. On arriving opposite this channel, a pusher, actuated by the cam teeth, pushes the type off the receiving table into the channel, down which they pass. All the type in this channel are lying on their sides, and the next operation is to arrange them side by side as they appear when printed. This is done by another pusher which works across the channel, and which pushes each type in succession to one side, thus bringing it over the mouth of a vertical tube, down which it passes. The machine is stated to be capable of setting on an aver-

age 12,000 letters per hour, or about as much as a column of the *Times*. The distribution of the letters into duplicates of the pockets is performed by boys.

It will be evident from the above description that this machine presents even more advantages for a newspaper than for ordinary books. Duplicates of the perforated paper can be taken and forwarded to any part of the country. As in all other type-composing machines, however, the great drawback is the taking down the type after it has been used. Until a machine has been invented to *distribute* the type, and to place them ready for again being set up, any advantage it may claim will be seriously impaired. Each line must also be spaced by the hand, and as only one person is able to do this at a time, the advantage of so much type being set up in straight lines is somewhat minimized.

One of the earliest type-composing machines was introduced by M. Ballanche, of Lyons, about 1841. Since then many other machines have been devised, both in Europe and America.

PRESS-WORK.

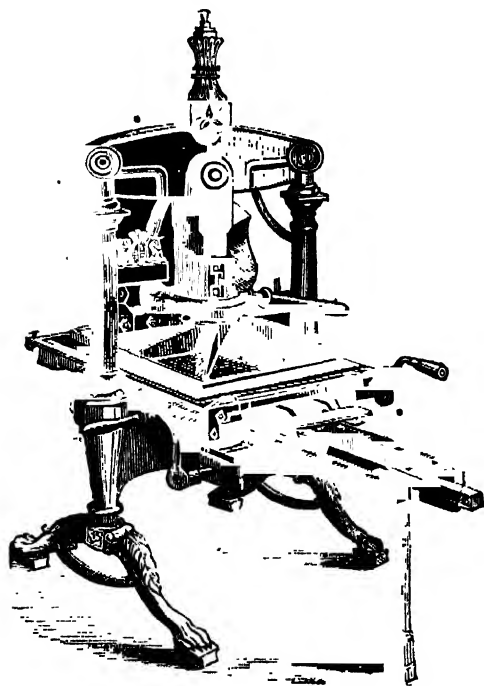
Printing Press.—In the early days of the art the printing press was a rude affair. It was made of wood, with an iron screw, resembling in appearance an ordinary screw-press, with a contrivance for running the inked forme of type under the point of pressure: to the lower end of this screw was attached a flat horizontal piece of wood, called the *platen*, which, being brought down by means of the screw, pressed the paper upon the face of the types. Great improvements were introduced into this rough mechanism by Willem Jansen Blaew, an ingenious mechanician of Amsterdam. In his press the form of type was placed on a carriage and wound below the point of pressure, and the pressure given by moving a handle attached to a screw hanging in a beam with a spring, which spring caused the screw to fly back as soon as the impression was taken. Fig. 1, Plate II., gives, in perspective elevation, an illustration of the old wooden press, with the balls used for inking the type.

This species of press, which was almost wholly constructed of wood, continued in use all over Europe until the year 1800, when a more manageable piece of mechanism was constructed by the ingenious Earl Stanhope (fig. 2, Plate II.) The *Stanhope Press* was made of iron, the principal improvement being in the motion by which the screw was made to descend. The bar or handle, *n*, was fixed to an upright spindle, *m*, to which a lever was attached, connected with a second lever fixed to the top of the screw by a connecting bar. These two levers, *r*, *r*, being placed at right angles to each other, when the platen was brought down to the face of the forme, took such a position with each other as to act with great advantage, and secure a wonderful increase of power; so that the pressman could not only print larger sheets of paper, and in a superior manner, but with greater ease and rapidity. Earl Stanhope's invention was followed by a number of modifications, in some of which the screw was dispensed with, the pressure being given by levers.

The *Columbian*, invented by Mr. G. Clymer, of Philadelphia, was introduced into this country in 1817. In this press the power is given by a series of levers, the return of the bar and levers being effected by means of counterpoises. For large and heavy formes this press is much preferred, the leverage enabling the workman to feel his way down to the very face of the type, thereby tending very much to delicacy and exactness in printing.

The *Albion*, invented by Mr. R. W. Cope, of London, is represented in the annexed engraving. Differing in principle from the *Columbian*, it has all the essential requisites of a hand-press—speed, light pull, and great durability. In this press the impression is given by a knuckle-joint. The two parts of this joint lying at a slight angle, when

the pull is made they are brought into line with each other, and the platen is thus brought down. The return is effected by a helical spring inclosed in an upright projection upon the head of the press.



Albion Press.

In connection with fig. 2, Plate II., the process of printing may be described; and it should be understood that although hand-presses are almost obsolete, yet the principle and main features of the process of making ready, inking, and printing are much the same at the steam machine of to-day as they were at the Stanhope press of our fathers. In working a hand-press two workmen are required—one to ink the forme and attend to the colour of the impressions, the other to lay on the sheets and work the press. The forme, *A*, being laid on the carriage, *K*, of the press, is firmly secured at the sides, in order to render it immovable while working. A blank sheet of paper, similar in size to that to be printed on, is then carefully folded according to the crosses of the chesne; this sheet is next opened up and laid on the forme. The tympan, *B*, being slightly damped, is closed down on the forme and an impression taken; when brought back, the sheet adheres to the tympan, where it is fixed, and serves as a guide for the subsequent “laying on” of the paper to be printed. This sheet is termed the “tympan-sheet.” The next operation is to secure *register* (one of the greatest niceties connected with the art), *i.e.* to arrange so that not only every page, but every line, shall fall exactly upon the corresponding line or page on the opposite side of the sheet. To secure this effect, the forme having first been thoroughly squared and adjusted, points are selected (small pieces of fine-pointed wire), *D*, and attached to the centre of the rim of the tympan; these produce small perforations in the centre of the sheet during the first impression, and the sheet being laid on, in the second impression, exactly on the same points, the impression is found to correspond. The tympan, which is in two pieces, is formed of parchment, rigidly stretched on slight iron frames, the two parts fitting into each other, but leaving space for a blanket or other material to be placed

between them; the whole being connected to the carriage by a hinge, and folding down upon the forme like the lid of a box. To lift the sheet off the forme when it is printed, a skeleton-like frame, termed a *frisket*, *C*, is made use of, which is in turn hinged to the upper end of the tympan. The frisket is made of stout paper, stretched upon a slight iron frame, on which, an impression having been pulled, all the printed portions are subsequently cut away, and serves the double purpose of retaining the sheet and preventing its being soiled.

Having proceeded so far the pressman next prepares to *make ready* his forme, which is done in the following manner:—Laying a sheet of white paper carefully over the tympan-sheet, he closes down the frisket over it, shuts down the frisket and tympan upon the forme, runs the carriage under the platen, *F*, and pulls the bar, *H*, with his whole weight until it has gone its full extent; the platen is thus made to descend, and an impression is produced. Gradually releasing his *pull* the bar returns to its original position, the carriage is run back, and the tympan and frisket raised. The sheet is then removed from the points and examined. The first impression is generally very defective and irregular—the parchment of the tympan may be of unequal thickness, the blanket worn thin, or the type not level; with formes of stereotype plates the irregularity is still more marked. To remedy these defects he then proceeds to make an *overlay*, which is done by filling up all deficiencies in the sheet by pasting on corresponding pieces of paper, and cutting away all the heavy portions. When finished, this sheet, which is called a *skeleton*, is placed inside the tympan, along with the blanket. This operation is repeated until the impression is made thoroughly regular, when a properly printed sheet is submitted to the overseer, who, if satisfied, directs the pressman to proceed. In making ready stereotype plates *underlays* are placed below the plates, in addition to the regular overlay.

In the preparation of wood engravings the highest skill of the workman is developed. A glance at any well printed “cut” will show how the lights and shades are graduated, all of which is effected by the *overlay*, the surface of the block being level. Formerly wood engravings were burnished lower in light places; but experience has proved that this can be best accomplished by means of the overlay, which is made to give the proper amount of impression on the different parts of the engraving; the deeper shades requiring more and the lighter parts less impression.

In printing the second side of the impression a clean sheet, which has to be frequently renewed, is placed over the face of the tympan, in order to prevent the sheets from being soiled by the “set-off” of the damp ink which the pressure produces.

In working the press the two pressmen alternately take the duties of *pulling* and *inking*. When finally worked off the formes are washed with lye and water to remove the *ink*, and taken back for distribution.

Inking and Rollers.—Much of the beauty of fine printing depends on the care exercised in the operation of *rolling* or *inking*. In the earliest stages of the art ink was applied by stuffed balls or cushions covered with skin, which have, however, been entirely superseded by composition rollers, first introduced about 1814–15. These rollers are commonly made of a mixture of treacle and glue, which, after being melted, is poured into an iron mould, in which the central rod (usually of iron, with a coating of wood) has been previously inserted. When taken from the mould the roller is a simple cylinder of soft elastic matter, and cannot be used until it has attained a particular firmness, varying according to the work for which it is intended.

Standing directly in front of the inking-table, as shown in fig. 3, Plate II. (usually made of polished iron), the workman places a little ink upon it, which he distributes

upon his roller by drawing it backwards and forwards upon the table. He then applies it to the surface of the forme in the same way, again rolling backwards, and forwards to insure its being thoroughly gone over.

Paper.—Before the paper is ready for printing it is usually damped for several hours, in order that the ink may adhere more readily. For finer work it is not unusual to calender the paper before printing, and of late years there is a growing tendency to print this paper dry. After printing the sheets should be dried, and then pressed to remove the indentations of the types. They are then ready to be folded, bound, and issued to the public.

Printing Machines.—It is obvious that by the most improved hand-presses the labour of printing must be great, and that no extraordinary expedition could ever be possible. The hardest work and the highest skill could not turn out more than 200 perfect copies of a newspaper per hour; consequently, as a taste for reading increased, and more rapid production became necessary, in order to publish them in time two or more formes of type were set up, and worked off simultaneously at as many presses. The great expense thus incurred made it desirable to secure some more expeditious method of obtaining impressions from type, and finally led to the great improvements of recent years in printing machines, which have quite superseded hand-presses, except for work in which only a very limited number of copies is wanted.

In the year 1790 Mr. Nicholson, editor of the *Philosophical Journal*, took out a patent for certain improvements in printing; and it is remarkable that in this patent he lays down almost every principle which has since been successfully applied to printing machines. He attempted, however, to form the types upon a tapering body, so that they might be placed on the surface of a cylinder, and kept compact like the vossours of an arch (figs. 4 and 5, Plate II.), and this introduced such serious technical difficulties that with him the ideas remained ideas; he did not translate them into facts.

The first working machine was constructed by Mr. König, a German, who, coming to England about 1804, submitted his invention to Mr. Bensley, the printer, and Mr. Taylor, a scientific writer of repute. This machine comprised the two principal features of Mr. Nicholson's patent—the cylinders and inking rollers. They encouraged him to proceed. He next obtained an introduction to Mr. Walter, proprietor of the *Times* newspaper, who at once saw the advantages of the projected machine, and assisted Mr. König in carrying it into a reality; and on the 28th of November, 1814, he was able to announce to the readers of the *Times* that they held in their hands a newspaper printed by steam-propelled machinery. In König's machine the type passed under a cylinder, on which was wrapped the sheet of paper, the paper being secured by means of tapes. The ink was placed in a cylindrical box, and forced from it by a powerful screw, depressing a tightly fitted piston; thence it fell between two iron rollers, below which were placed other rollers, two having, besides their rotary motion, an end motion, that is, a motion in the direction of their length. The whole system of rollers terminated in two, which applied the ink to the types (fig. 6, Plate II.)

As yet only one side of the sheet was printed at a time; but the utility of the cylinder having been proved, it became desirable to apply the principle to the execution of book-work, where printing both sides of the sheet, together with accurate register, was necessary.

By multiplying the cylinders, and other modifications, Mr. König contrived to print both sides. The sheet was conveyed from one cylinder to the other by means of tapes; the course of the sheet resembling a couple of abrupt curves, as shown in fig. 7, the sheet being turned over as it moved. This machine turned out 750 sheets per hour,

printed on both sides, and was considered by the patentees to be incapable of further improvement.

In a machine constructed by Messrs. Donkin & Bacon, inking rollers, covered with a composition of treacle and glue, were first used. The rollers had formerly been covered with leather, and had never answered properly.

In 1818 Messrs. Applegath & Cowper took out a patent for improvements in cylindrical printing machinery—the chief being the application of two drums placed between the cylinders to secure accurate registering, over and under which the sheet is conveyed in its progress from one cylinder to the other; and the mode of distributing the ink upon flat movable iron tables. Plate III. represents one of Applegath & Cowper's ordinary perfecting machines, as originally patented. Machines constructed upon these principles are now in use for book-work in all our principal printing establishments. They are moved by steam power, and require the attendance of two boys. The *modus operandi* is as simple as it is ingenious, and in general terms may be thus described (see Plate III. fig. 1):—

The blank paper which is to be printed is laid on a table, A, by the side of which, on a raised platform, stands a boy, called the *layer-on*, who places the paper, a sheet at a time, upon the *feeder*, F, which has a number of linen girths or tapes passing across its surface, and extending to a roller at each end of the feeder, so that when the rollers are partially turned round, the motion of the girth carries the sheet forward under the *web roller*, C, and the *smoothing roller*, D, and delivers it over the *entering drum*, E. The partial revolution of the feeder is accomplished by a lever actuated by a cam on the axis of the printing cylinder. By this means, provided a sheet of paper be placed upon the feeder once during every revolution of the cylinder, the former takes it into the machine at the right moment, and thus prevents it from occupying a wrong position, or interfering with the sheet which is actually being printed. The feeder thus delivers the sheet of white paper to the entering drum, where it is seized by the systems of endless tapes, which pass over a series of rollers to keep them extended. These tapes are so contrived as to fall between the pages of the printing and on the margins or edges of the sheet: this allows them to remain in contact with both sides of the sheet during its entire passage through the machine, and in this way the paper is conveyed from the one printing cylinder to the other, without disturbing the register or coincidence of the pages on opposite sides of the sheet. As the sheet is carried along between the tapes, it applies itself to the blanket on the printing cylinder, R, revolving below which it receives the first impression; the sheet, now printed on one side, is carried over R and under R to the blanket on the cylinder, C, where the sheet is found to be inverted, the printed side being next to the blanket, and the blank side outward, which, meeting the second forme of type at the proper moment, receives the second impression, and completes the sheet. On reaching T, where the two systems of tapes separate, the perfect sheet is thrown out into the hands of the *taking-off* boy. The printing cylinders are of iron, turned quite true, and are covered with *blankets* of fine woollen cloth. Part of the circumference is cut lower than the rest so as not to come in contact with the forme at the wrong time. They are mounted on strong axles, which turn in bearings attached to the main frame of the machine, and can be adjusted, by means of screws, to suit the amount of pressure required. The cylinders and the drums are all connected by toothed wheels, so as to insure a uniform and steady motion.

The conveyance of the sheet with accuracy and speed by means of the tapes is an important feature of the double-cylinder machine, and will be readily understood by reference to the diagram, fig. 2, Plate III.

The two formes of type required to print the sheet on both sides are placed at a certain distance from each other

on a long carriage, and close to each forme is an inking table, consisting of an extended metal surface, also supported by the carriage. The carriage, with the two formes of type and inking tables, moves backwards and forwards on rollers, and in its progress brings the type at the proper moment in contact with the sheet of paper as it revolves on the surface of one of the printing cylinders. This reciprocating movement is effected by a pinion working into the alternate sides of a rack under the tables, and motion is given to the pinion by bevel wheels, x.

The mechanism for supplying and distributing the ink upon the type is one of the most important sections of the machine, and is performed by means of rollers, as formerly mentioned, of which there is a similar set on either end of the machine. The ink is contained in a duct, in which a metal roller, r, revolves, motion being given to it by a band from the printing cylinder, c. A small vibrating roller is made to work between the ductor roller and the inking table, delivering a small regular quantity upon it each time it arrives at either end of the machine. Three or four diagonal rollers, m, which rotate entirely by the friction of the table, distribute this ink on the table, whence it is taken and delivered upon the type by rollers, n, as the formes of type pass below them.

The small diagrams on Plate II., figs. 4-12, will convey an idea of the earlier varieties of inking apparatus and arrangements of machines which we have described. Fig. 4 is Nicholson's machine for arched type; fig. 5, Nicholson's machine for common type; fig. 6, König's machine for one side of the sheet; fig. 7, König's for both sides; fig. 8, Donkin & Bacon's for one side; fig. 9, Cowper's for curved stereotype and one side of the sheet; fig. 10, Cowper's for both sides, with curved stereotype; fig. 11, Applegath & Cowper's for one side, and for common type; and fig. 12, Applegath & Cowper's for both sides of the sheet, as now in use, and described above. In all these diagrams the *black* parts represent the inking apparatus; the *diagonal* lines represent the cylinders on which the paper revolves to receive the impression; the *perpendicular* lines represent the types or plates; and the *arrows* indicate the track of the sheet of paper.

The enormous increase in the circulation of newspapers, however, demanded a corresponding increase in their production; and in 1848 a new machine was constructed by Applegath for the *Times* newspaper. This machine had a vertical cylinder, 64 inches broad, on which the type was fixed, surrounded by eight smaller cylinders, each about 13 inches diameter, and covered with cloth, round which the paper was led and delivered by tapes, each impression cylinder having a feeding apparatus, with two attendants for feeding and taking off. By this machine 11,000 copies per hour were thrown off.

Notwithstanding the great productive powers of Applegath's machine the still increasing requirements of the *Times* and other newspapers made it necessary that something more should be effected. In this emergency an American machine, the invention of Messrs. Hoe & Co., of New York, was successfully introduced. It was called "The Type Revolving Fast Printing Machine," and was made with from two to ten impression-cylinders. Hoe's process consisted in placing the types on a horizontal cylinder revolving on its axis, against which the sheets were pressed by smaller exterior cylinders. The pages of type were arranged in segments of a circle, each segment forming a frame that could be fixed on the cylinder. The type formes occupied only a portion of the cylinder, the remainder affording space for the inking apparatus. The smaller surrounding cylinders for giving the impression were arranged in a framework, in connection with inclined tables, from which the sheets were fed; the taking off being performed with great regularity by means of a self-acting frame or flyer, which rose and fell with each impression of the print-

ing cylinders. The size of the main cylinder, the number of exterior cylinders, and the rate of speed at which the machine was driven, determined the number of copies printed per hour.

The first Hoe machine introduced into Europe was made for a Paris newspaper in 1848, and the next was one with six cylinders for *Lloyd's Weekly Newspaper*, in London, in 1857. These were followed by two ten-cylinder machines for the *Times*, manufactured by Mr. Whitworth, of Manchester; and they were soon adopted in all the principal newspapers throughout Great Britain. This machine, however, was too complicated and liable to trivial accidents, involving stoppage and loss of time, and it was completely superseded on the appearance of a new class of machine which prints paper in a continuous roll instead of in separate sheets. The first machine of this kind was shown in the International Exhibition of 1851 by Mr. Thomas Nelson, the well-known Edinburgh publisher; but though it was at once seen that it was chiefly suited for rapid and coarse work, the merit of the invention was strangely overlooked, and it was not till about twenty years later that the idea was put to practical use in the Walter newspaper machine.

The Walter machine (shown in Plate IV.) is what is called a "perfecting" machine, as it prints both sides of the sheet at one operation. The manual skill required in other machines to lay on sheet after sheet with the requisite accuracy is entirely dispensed with. The printing is entirely done from curved stereotype plates. As the *Times* is now printed, a reel of tightly rolled paper, in the form in which it leaves the paper mill, more than 4 miles in length and weighing fully 6 cwt., is placed at one end of the machine, and in the process of unreeling is damped, printed first on one side and then on the reverse with unfailing precision, is cut into sheets, folded, and delivered at the rate of at least 12,000 copies per hour at the other end of the machine. Whilst printing the paper travels through the machine at the rate of nearly 1000 feet per minute, and a reel of paper 4 miles long is thus printed in less than twenty-five minutes. Formerly the *Times* had to be printed by four large machines, each requiring the combined action of from fourteen to sixteen hands to work it. The speed was governed by the limit of dexterity in the layer-on; but that of the Walter press is, on the other hand, independent altogether of manual dexterity. Experiments conducted in the *Times* office in London and the *Scotsman* office in Edinburgh have shown that the machine can produce excellent work at the rate of 15,000 or even 17,000 complete copies of an eight-page paper per hour.

It would be out of place to enter into the minor technical differences between the different machines of this type. The chief of them are the Walter, Hoe (new), Victory, Prestonian, Northumbrian, and Marioni. We may also mention the Whitefriars rotary machine, which prints either separate sheets or from the web, and Messrs. Hoe now promise a still newer rotary, which will print and fold 50,000 copies of a four-page paper or 25,000 copies of an eight-page in an hour!

In the machines above mentioned the stereotype plates are bent, and fastened round the cylinders of the machine. It was found impracticable, however, to print illustrated papers in this way, owing to difficulties in "bringing up" engravings by processes of "overlying" and "underlying," and the more careful inking which engravings require. Mr. W. Ingram, however, of the *Illustrated London News*, set to work to solve this problem, and in 1877, by means of the Ingram Patent Rotary Machine (Plate V.), he had the satisfaction of seeing his paper, plates and letterpress together, printed from cylindrical plates, and turned out, completely folded, at the rate of 6500 copies per hour. The additional attention to the plates is effected by having cylinders of varying size; those carrying the engravings are large and comparatively slow. By having duplicate sets of stereo-

type plates, however, the engravings fully keep pace with the more agile type cylinders. The rate of 6500 per hour was merely the beginning. It is now possible to work with larger cylinders, capable of receiving a duplicate set of stereotype plates for the letterpress, and a triplicate or other suitable number of sets of cuts for the engravings, and the turn-out per hour is thus multiplied in proportion.

BOOK-WORK AND JOBBING MACHINES.

The later stages of the history of the development of the many forms of the modern printing machine becomes so complicated that we must now abandon the method of explaining it historically, and content ourselves with a brief classification and analysis of the chief characteristics of the different kinds of machines now in use. Hitherto newspaper machines have been described: they are designed to attain enormous speed of production, and this is attained at such a sacrifice of the quality of the printing done that they must be regarded as a class quite apart from the machines which we will now describe, and which are designed for book-work and all sorts of cards and leaflets, which are known as jobbing work. Printing machinery for *book-work*, as at present constituted, may be conveniently divided into two classes—*flat-pressure* and *cylinder* machines.

Flat-pressure or *platen* machines were first constructed, we believe, in 1830, and are simply a development of the hand-press, but are worked by steam: the type rests on a carriage as before, and the sheet is laid on a framework (frisket), which is fastened to the carriage just above the type; the tympan, hinged to the frisket, is lowered on it, and the carriage then runs under the platen, which descends, presses the paper on the type, and then rises again; the carriage then runs out, the printed sheet is removed, and a fresh one is laid in its place. The inking apparatus is simple, and consists of an ink duct, vibrating roller, two sets of rollers, and an inking table. The table is usually flat, fastened to the carriage next the pages of type, and runs to and fro with them; the vibrating roller takes a regular supply of ink from the duct (or "block") and lays it on the table, where it is first evenly spread (or "distributed") by one set of rollers, and is then taken up and transferred to the type by the second set, which first passes over the table, and then over the type. In the hands of different makers it has assumed various modifications; sometimes it is made with a single end, but more generally works from two ends, when it is known as the *double-platen*. Although simple, and admirably adapted for fine work and short numbers, this machine is almost wholly superseded by *cylinder* machines, which are quicker and more generally useful.

The majority of *cylinder* machines differ from each other rather in detail than in principle. The type, stereo plates, or wood blocks usually rest on a flat carriage, to which is fastened the inking table. The carriage runs to and fro as in platen machines, so that the type passes first under the inking rollers, and then under an iron cylinder instead of a platen; the cylinder bears on its surface the sheet which is to be printed, and as the type passes under the cylinder it revolves and presses the sheet on the type, which thus gives the desired impression. These machines vary much in detail; in some the sheet is held against the cylinder by endless tapes, in others the sheet is caught and held by the margin by means of small brass "grippers." Some cylinders are geared to the table, and rock backward and forward, in accordance with the movements of the table, with a sort of "cradle" motion; while others work intermittently, standing still while the carriage is running back, and then making one complete revolution while the carriage runs forward.

Cylinder machines in which the type (or plates) rest on a flat table may be divided into two classes, according as the sheet is held by tapes or by grippers while being printed.

(1) In *tape machines* the sheet is taken away, transferred from cylinder to cylinder, held while being printed, and finally "delivered" printed by means of *tapes*, as already described on page 215.

(2) *Gripper machines* have a number of strips of metal fastened by one end to a rod which lies in a longitudinal recess in the cylinder, just at the commencement of the printing surface; the other ends of these strips or "grippers" rest on the edge of the recess in which the rod or "gripper bar" lies. At the proper moment the rod is twisted by a crank and raises the grippers, the white sheet is then placed in the edge of the cylinder; when the crank at the end of the gripper bar is released the bar is turned back to its original position by a spring, and the grippers close with a snap on the edge of the sheet and take it away to be printed as the cylinder revolves. In double or two-cylinder machines each cylinder has a set of grippers; the cylinders revolve continuously and are placed close together and so arranged that when the first side of the sheet is printed the two sets of grippers come together, and while the first set opens the second set gets under the edge of the sheet and then closes upon it, and takes the sheet off the first cylinder on to the second, which prints the second side of the sheet. Both in gripper and tape machines, when the paper shows a tendency to crumple, it is sometimes necessary to use extra tapes, called smoothers, but these are not essential parts of the machines.

Single-cylinder machines are usually gripper machines, and may be broadly divided into two classes according to the way in which the cylinder revolves.

Machines of the earlier class, in point of time, are usually called *Main's* or *cradle machines*. In them the table has a rack at each side, and the cylinder a toothed wheel at each end; the wheels and racks are always in gear, and as the wheels are fixed to the cylinder the latter rocks alternately forwards and backwards with a sort of cradle motion, following the motions of the table. The cylinder only delivers an impression while moving forwards, and it is then slightly raised by a crank motion so as to keep it free of the forme while it and the table return backwards.

In the *Wharfedale* or "stopping cylinder" type the cylinder moves intermittently, making a complete revolution when the table runs forward, and standing still while the table returns back to its starting point. The table has a toothed rack at each side and drives the cylinder by means of toothed wheels, of which the cylinder has one at each end. One of these wheels is fastened to the cylinder and only revolves forward with it; some of its teeth are therefore cut away to take it out of gear with the rack, so that the table may run backwards. The other is always in gear with the rack, and bears on its inner side a heavy pawl, opposite which there is a projection on the cylinder. When the table and toothed wheel run backwards the pawl slips over the projection, but when they turn to go forwards the pawl falls down, strikes on the face of the projection, and throws the cylinder into gear, so that it makes its forward revolution. This pawl can be thrown either permanently or intermittently out of action, so that the table may pass any desired number of times under the inking rollers while the cylinder remains stationary. Of all British printing machines this type is perhaps the most simple, useful, and most widely used. Two examples are given in Plate VI., which differ chiefly in the position of the feed board, one being at the bottom of the cylinder (fig. 1) and the other at the top (fig. 2). In both machines the printed sheet is "taken off" the machine by a frame, *c*, consisting of a set of long fingers, with an intermittent to-and-fro motion, which is termed a "fly." The paper is delivered to the fly by a small cylinder, *n*, geared to the larger one, *A*, which seizes the sheet after printing by means of grippers. In order to print the second side of the sheet it has to be passed again through the machine.

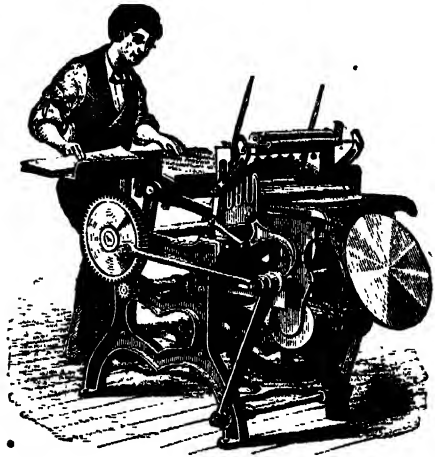
In France, Germany, and in many English lithographic machines a different motion is adopted to stop and start the cylinder. There is usually only one toothed wheel, and it is fastened to the cylinder and has some of its teeth cut away as in the Wharfedales; on the side of the cylinder is a projecting pin which fits into a fork, cut in the end of an upright lever. This lever is worked by a cam motion, and when the table starts to run forward the lever presses on the pin, so as to turn the cylinder sufficiently to throw the toothed wheel into gear with the rack on the table; the pin then quits the fork and the cylinder makes a complete revolution, at the end of which the cut away part of the toothed wheel comes opposite the rack, and they therefore go out of gear; but just before this happens the fork, which has shifted its position, catches the pin on the cylinder, and holds it fast till the table has run back to the starting point.

The *two-cylinder or perfecting machine* is of a more complicated type. In principle it is simply a single cylinder machine doubled, and it is so contrived that after the sheet has been printed on one side by the first cylinder it passes on to the second and is then printed on the other side, so that it leaves the machine perfected. The two main varieties of double machines are the English (above described as Applegath & Cowper's), characterized by its large rigid cylinders and by the sheet being held in its place by tapes; and the French (shown in Plate VII.), in which the sheet is held by grippers, and the cylinders, besides being of less diameter, alternately descend to give the paper the desired impression, and then rise to let the carriage return to the starting point again. In this class of machine the cylinders each make *two* revolutions for every impression, but during one of the two they are raised out of contact with the forme by a knuckle-joint and cam, which in bringing one cylinder into printing position also raises the other out of the way. A contrivance also exists in this machine whereby a *slip* or waste sheet is interposed between the second cylinder and the freshly printed side of the sheet while the second side is being printed, thus avoiding the risk of the sheet being soiled by ink from previously printed sheets. In 1885 a new form of perfecting machine was introduced by Messrs. J. H. Buxton, D. Braithwaite, and M. Smith, of Manchester. This machine (shown in Plate VIII.) has only one printing cylinder, A, but this cylinder is large enough to print two formes, one after the other, at each revolution. It is provided with *two* sets of grippers and *two* smaller cylinders, n and c, which take off the sheet (by means of grippers) when it is printed. The sheet is fed into the machine and the first side printed in the usual way; on reaching the "take off" cylinder, D, it is released from the grippers of the printing cylinder and placed upon a feed table, D, where it is automatically adjusted to certain guides, by which the register is secured. This table works on a hinge at its upper end, and as soon as the sheet has been placed on it, it sinks some inches and presents the edge of the sheet to the second set of grippers on the printing cylinder. These take the sheet now with the white or unprinted side upwards, and the second forme is printed as the first was. The sheet is then taken off again by the small cylinder, C, and finally placed by a *fly* upon the heap of finished sheets. The machine can be run at a much higher speed than the French type of perfecting machine, and its simplicity and accessibility for making-ready are points greatly in its favour. The printing cylinder is propelled in the same way as that of the ordinary Wharfedale, and like it, can be thrown out of gear at any time.

Two-colour Machines.—Machines for printing two different colours on the same side of a sheet are constructed on a similar principle, except that no contrivance is required for reversing the sheet. The cylinder makes two revolutions as the formes pass under it, and each forme is in

turn impressed on its surface. The inking rollers are so arranged as to come in contact only with that forme which requires ink of the colour which they furnish.

The American "liberty press" is perhaps the most widely used of modern inventions in printing machines for job work. Strange to say, it is a reversion to the original flat-pressure system of the hand-press. It practically consists of two flat surfaces hinged together like a book, the type is placed on one surface and the sheets of paper on the other, so that when they close the type is



Liberty Press.

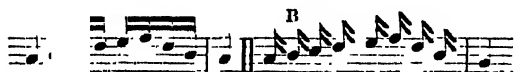
pressed on the paper; as they open again the printed sheet is replaced by a white one, and meanwhile the type passes under the inking rollers to get a fresh supply of ink. In more recent adaptations of this machine the type surface remains stationary and perpendicular, while the platen surface becomes horizontal to receive the paper, and then turns over to the perpendicular to deliver the impression.

The rotary principle is applied to very small machines for printing large numbers of small and coarse handbills, and the newspaper type of machine is adapted to printing pawn and trainway tickets. Tiny machines are constructed to print visiting cards, and special presses are made where-with anyone may attempt the laborious and somewhat unsatisfactory experiment of becoming his own printer.

In the article ENGRAVING we have already described the method by which copper and steel plates are engraved. The process of printing from them differs essentially from that adopted in letterpress work, being from *intaglio* instead of a raised surface. As soon as the plate is finished by the engraver it is ready for press. Having previously dampened the paper to be printed the workman places the plate upon a small stove, heated by gas or otherwise. When sufficiently heated to assist the ink in finding its way into the lines, he daubs over the whole surface of the plate with a thick oleaginous ink. The ink being well rubbed into the lines he proceeds to clean the plate, by wiping off the spare ink from the surface, and finally polishing it with the palm of the hand. When thoroughly cleaned he lays the plate upon the flat table of a press, and places over it a sheet of the paper which is to receive the impression; he then, by turning a handle, causes the plate and table to pass beneath a roller covered with blauketing, under a sharp pressure, by which the ink is forced from the hollow lines on to the paper, and thus produces the impression. This process of inking, &c., is repeated for each copy required, the skill of the printer being shown by the way in which he wipes away the superfluous ink, and yet leaves sufficient on the various

parts to preserve the proper balance of light and shade. A machine for printing copper plates by steam was shown in the Paris Exhibition of 1878, but has not yet been brought into general use. See ENGRAVING, PHOTOGRAPHY, and PHOTO-LITHOGRAPHY.

MUSIC PRINTING.—The earliest music-printing, like the earliest book-printing, was simply a branch of wood engraving; the whole page was cut, the lines and notes being left standing and the interstices cut away, so that impressions of the parts in relief were taken, as in woodcut printing. German examples of this style are extant as early a date as 1473. It is true that the Mainz Psalter, one of the glories of the British Museum, is as early as 1457, but this is a black-letter book printed on vellum, with music lines in red where required, the notes being afterwards written in by hand. Within the next ten years (1482 and onwards) an improvement was made by the introduction of type, the lines being first printed in red, and the notes being set up in a different "forme" and printed in black as a second operation. This served for simple work, but elaborate work still demanded the copperplate engraver's art. About the year 1500 Ottaviano de' Petrucci, at Venice, so improved the type of the notes that he was able to print almost anything, and from this date the use of movable type may be reckoned fairly to begin. Petrucci still used two printings, one for the staves and another for the notes. The final improvement was made by Erhard Eglin of Augsburg, who in 1507 joined parts of the stave to the notes, so that all could be fitted together and the whole page set up at one operation. It took another quarter of a century to perfect the details of this arrangement, but by 1536 Gardano at Venice was printing very good work indeed from type. The great edition of Palestrina's Masses in parts (Rome, 1572), though coarse, is very good and legible. At first all the notes were distinct; thus the passage which we should print as at A was always printed as at B (of course not as yet in rounded notes).



But in the year of the Restoration (1660) Playford introduced the practice of binding quavers and notes of lesser value into groups of three, four, six, or eight, as we do now; and soon afterwards the lozenge-shaped notes, which had hitherto been used, gave way to the rounded shapes from which our present notes have come. The music type-printing of the present day is but an improvement in details of arrangement, in sharpness of cutting, hardness of metal, &c. The application of stereotyping (beginning about 1800 in Germany) has enabled very costly type to be used, because the printing is not from the type itself (which would soon wear it out), but from the plates or moulds of impressions cast from the page of type after it is set up and corrected. Besides, there are devices for touching up the stereotype plates which improve even upon pages printed direct from the type. The parts of notes required for music-printing are very numerous, as the subjoined illustration shows. The musical illustrations in the present work are all from type.



Passing by the application of lithography to music-printing, which has never been very extensively followed, and may be omitted, therefore, with this cursory mention, we come to the other general method of music-printing, namely from engraved plates. This is as closely allied to copperplate engraving in its nature as the early wood-

block pages already spoken of were to woodcutting. The music was at first cut in plates as if it were a picture being engraved. Ink being rolled on to the plate the surface was wiped off, and the ink remained only in the hollows, whence it was sucked up under pressure from above by plate paper, as with engravings. Engraved music is known as early as 1586 (Martin Van Bayton, published at Rome in that year by Verodio), and came into great favour subsequently, fine specimens both of French and German work being produced in the next century. The great Bach was a famous engraver, and hurt his eyesight by his devotion to the art. Fine specimens of English work during the "Elizabethan period," but in the reign of James I., still delight the eye of the connoisseur, in our great collections.

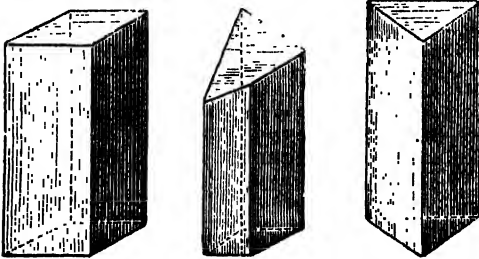
About the year 1700, in Holland, the excellent idea was hit upon which at once raised music engraving from an expensive luxury to a practical means of printing. This was the punching of the notes in softened plates, instead of the engraving of the notes in hard copper. And ten years later we in England completed the art in its new form by using pewter instead of copper. This method is followed at the present day exactly in the same fashion; only, to save the plates, the music is transferred from the plates to lithographic stones and so printed. It is hardly necessary to say that engraved music is more handsome to the eye, easier to read, in fact better and more artistic in every way, than type music. It is also cheaper for small issues, on account of the expense of "composition," which any one can see, from the example given above, is very great for musical type-printing. But for large issues the greater cheapness of printing renders the prime cost of "composition" less formidable, and type-music is by far more economical than engraved music in the long run. Also for works like the present the ease with which musical illustrations can be introduced among ordinary type is in remarkable contrast with the practical impossibility of using the lithographic or engraved methods, with their diametrically opposed manner of working.

PRIOR, MATTHEW, an English poet and diplomatist, was born at Wimborne, Dorsetshire, 21st July, 1664. By the death of his father he was left dependent on the bounty of his uncle, a vintner in London, by whom he was placed under the care of Dr. Busby at Westminster School. At his uncle's house he attracted the notice of the Earl of Dorset, who undertook the charge of his education, and sent him to St. John's College, Cambridge, where he took a B.A. degree in 1686, and became a fellow in 1688. At college he formed an intimacy with Charles Montague, afterwards the Earl of Halifax, and the two friends wrote together, in 1687, a satire on Dryden's "Hind and Panther," entitled "The Town and Country Mouse," which was very well received. By the interest of his patron, the Earl of Dorset, Prior was gazetted secretary to the embassy at the Hague in 1690, and four years later he was recalled to England and appointed one of the gentlemen of the king's bedchamber. At the negotiation of the treaty of Ryswick, in 1697, he was secretary to the ambassadors, and he filled a similar office in 1698 at the court of France, whither he accompanied the Earl of Portland. After his return he was made under secretary of state, and in 1700 he succeeded Locke as one of the lord-commissioners of trade. In 1701 he entered Parliament for East Grinstead as a Whig, but soon afterwards deserted his party and allied himself with Harley and St. John. When the Tories came into power in 1710 he was employed by the party as a diplomatist, and until the death of Anne he held a prominent position in all the negotiations with the French Court. The death of the queen and the return of the Whigs to power deprived him of his offices, and he was impeached by the House of Commons, committed to prison in June, 1715, and kept in close custody for nearly three

years. Released without a trial, he was for a time in straitened circumstances, but an edition of his poems by subscription brought him 4000 guineas, and Lord Harley also presented him with a small estate in Essex. He died at Wimpole, Cambridgeshire, a seat of the Earl of Oxford, 18th September, 1721, and was buried at Westminster Abbey, where his monument may be seen in Poet's Corner. His poetical works, in addition to the satire mentioned, comprise the "Carmen Seculare" (1690); "Alma, or the Progress of the Mind," composed during his imprisonment; "Solomon," a sacred narrative poem; sundry "Tales," witty and indecent, and some neatly turned epigrams. All his poems show marks of labour, and though they are quite destitute of fire and enthusiasm, they display much originality and power of thought. The last edition of Prior's complete works was issued in two vols. by Milford in 1835 with a memoir.

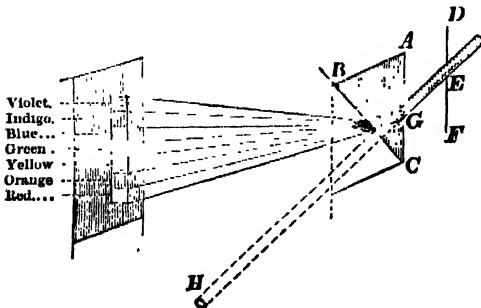
PRISC'IAN (*Priscianus Caesariensis*) flourished about 450 as a teacher of Latin grammar at Constantinople. His treatise on the subject became the standard Latin grammar of the dark ages, and was extensively used in epitomes. "Fit to break the head of Priscian" was the ancient phrase for a solecism in grammar.

PRISM (Gr. *prisma*), in mathematics, is a solid formed by a straight line which moves parallel to a given straight line, and one end of which traces out the contour of a given rectilinear polygon. The other extremity of the moving straight line traces out an equal and similar polygon, placed parallel to the former one: and the prism is thus bounded by two equal and parallel polygons, joined by as



Quadrangular Prism. Truncated Prism. Triangular Prism.

many parallelograms as each polygon has sides. When these parallelograms are at right angles to the planes of the polygons, the solid is called a right prism; in all other cases, an oblique prism. The prism is among plane solids

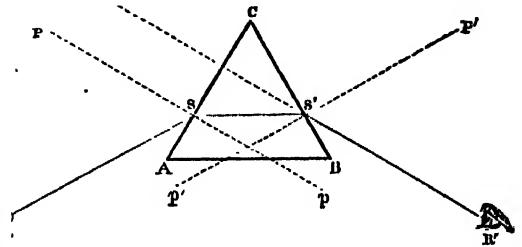


Prismatic Spectrum.

what the cylinder is among curvilinear ones. It is also called triangular, quadrangular, pentagonal, &c., according as the polygons have three, four, five, &c., sides. Thus the prism used in optics is a triangular prism, while the parallelepiped is a quadrangular prism. The use of the

prism in the formation of the spectrum by the refraction of light is known to everyone. If a ray of sunlight pass through a shutter, DE , at E , in the direction EN , and fall upon an inverted prism ABC , at the point C , it is bent upwards from its course, and as its component colours are unequally refrangible, the more refrangible are more bent than the less refrangible, and a band of colours is formed consisting of violet, indigo, blue, green, yellow, orange, and red bands, successively reckoning from the top downwards. See **LIGHT, SPECTRUM, &c.**

When a ray of light falls perpendicularly upon the surface of a refracting medium, bounded by parallel sides, as a plate of glass, it undergoes no change of direction; but in every other line of incidence it suffers refraction. The triangular prism of glass, having its sides inclined to each other at angles of 60 degrees, causes, therefore, a double refraction, once when the ray enters and once when it emerges. A cross section of such a prism is shown in the subjoined figure, of which AB is the base, and AC



and CB the refracting sides. If a ray of light, r , fall upon the side AC at s , it will be refracted from its course towards the base, and, consequently, towards the direction of rp , which is a perpendicular to AC ; and on emerging at s' , it will be bent away from $s'r'$, which is perpendicular to CB , and thus reach r' with its original deviation doubled. Hence, to a spectator at r' , an object at r would appear at x ; for the refracted ray $s'r'$, if produced, will reach x ; and objects always appear to be situated in the direction of the rays which eventually reach the eye.

PRISONS AND PRISON DISCIPLINE. At all periods and in all countries organized society has, of necessity, claimed the power to punish those who offend against it, and the nature of the penalties inflicted upon offenders will, in no slight measure, serve to indicate the stage of civilization at which a nation has arrived. In Great Britain, after the disappearance of Roman civilization (in which a high level of humanity and good order had been reached), the punishments inflicted upon criminals were of a sharp and decisive character. Offenders were whipped, branded, mutilated, and dismembered for serious offences, and fined, degraded, or deprived of civil rights for offences of a minor character. Under the feudal system, during which these punishments were common, with the addition of the frequent infliction of the penalty of death, imprisonment was a favourite method of coercion, and it also served at times to effectually dispose of those who incurred the displeasure of their liege lords. The power of arbitrary imprisonment, which lingered until a very late period on the Continent, was restrained in England by the granting of the Great Charter, and the right of being brought to trial after arrest has ever since that event been cherished and defended by Englishmen. In practice, however, the theory of the law was frequently disregarded, and there were numerous influences, such as the bitterness of party warfare, the law's delay and cumbrous action, the harshness of the criminal code, and the severity of the laws designed for the protection of trade, which served to keep

the prisons always full. Various causes also combined to render the administration of the national prisons ineffective and evil, and their condition and management, to go back no earlier than the eighteenth century, were of the most deplorable character. The condition of the prisons of England, and also of Europe, at the period when HOWARD began his self-sacrificing labours (1773) is well known, but he was not the first to expose the vices of the old system. In the reign of Queen Anne a well-conceived attempt was made to reform the London prisons by Dr. Bray and other members of that association, but the task was found to be so gigantic and so repulsive that after a short effort it was entirely abandoned. The description of the management of Newgate then given comprises—“(1) the personal lewdness of the keepers and under-officers, who often make it their business to corrupt the prisoners, especially the women; (2) their confederacy with prisoners in their vices, allowing the men to keep company with the women for money; (3) the unlimited use of brandy, wine, and other strong liquors, even by condemned malefactors; (4) swearing, cursing, blasphemy, and gaming; (5) old criminals corrupting new comers; (6) neglect of all religious worship.” A quarter of a century later public attention was again directed to the state of the metropolitan gaols by some dreadful reports which got abroad: a parliamentary inquiry took place, under the direction of General Ogleshorpe, and the revelations which it made as to the cruelties exercised in prisons, and the fearful immorality of all parties connected with them, produced a strong impression on the public mind. A change of keepers then took place, and some amendments were introduced into gaol administration; but the chief vices of the system remained until the time of Howard. In the first section of his work on “The State of Prisons in England and Wales,” which he entitles “A General View of the Distress in Prisons,” published in 1775, Howard presents a summary of the abuses which existed in the management of criminals at that time. These abuses related to food, ventilation, drainage, and want of classification of the prisoners, the effects of which were disease of the most terrible kind, and the further corruption and debasement of all persons who were confined in prisons. It must be borne in mind in connection with this part of the subject, that prisons were not then, as now, regarded as places of punishment, but rather as places of detention for debtors, persons awaiting trial, and prisoners tried and sentenced, who were awaiting the infliction of the penalties of death or transportation beyond sea. The penalty most relied on as a preventive of crime was death, and though of those who received a capital sentence, only a varying proportion were executed, the number actually hanged was still enormous. In 1797 the number of capital offences was 160, many of them, such as stealing linen from bleaching grounds, stealing to the value of 4s. from shops, &c., being of the most trumpery kind; but even this long list was not considered sufficient, and the number was afterwards raised to 222. As a result, prisoners were hanged in batches after every session. and Townsend, the famous Bow Street runner, in his evidence before a Parliamentary Committee, said that between 1781 and 1787, he had seen as many as twelve, sixteen, or twenty persons hanged at one execution. On two occasions he had seen forty hanged at once. The other penalty most in favour was transportation to the colonies in America, and prisoners condemned to this punishment were sold into a kind of white slavery in the American plantations. The achievement of independence by the colonists closed this channel for the disposal of English criminals, and in 1776 an Act was passed, which provided that convicts sentenced to transportation might be employed in hard labour at home. Two years afterwards another statute provided for the erection of penitentiaries, a commission of three supervisors being appointed to select and

acquire a site for the first of these buildings. Before anything had been accomplished, however, the discovery of Australasia opened a new field for convict colonization, and in 1787 a large number of convicted criminals were despatched to Botany Bay, the project for their employment at home being quite thrust into the background. In January, 1788, the convicts landed at Port Jackson and founded the colony of New South Wales. Acts were subsequently passed, authorizing the king in council to appoint definite places beyond seas, to which offenders should be conveyed. The places so appointed were the two Australian colonies of New South Wales and Van Diemen's Land; the small volcanic island called Norfolk Island, situated about 900 miles from the eastern shores of Australia; and Bermuda. Every year, from 1788, saw a large number of criminals transported to one or another of these convict stations, and no serious attempt to carry out the aim of the Penitentiaries Act was made until 1813, when the erection of the vast establishment at Millbank was commenced. Large sums were expended upon the erection and subsequent maintenance of this building, and its internal discipline was arranged upon a system designed to promote the reformation of the prisoners, as well as to punish them for their crimes. In the country generally, however, the prisons still remained in a deplorable condition, and the labours of some earnest members of the Society of Friends, of whom Mrs. Fry is the most celebrated, resulted in the disclosure of a condition of things not much better than that of some fifty years earlier, when Howard had begun his mission. To remedy these evils the Prison Discipline Society was formed, and among other results of their labours certain Acts of Parliament were obtained (1823-24), which provided for the separation of male and female prisoners, the appointment of matrons for the oversight of female prisoners, for the enforcement of hard labour upon all prisoners sentenced to it, and for the isolation of the prisoners from each other as far as possible. It was not without strenuous labour that these Acts were obtained, and even when they had become law the local authorities, who had the control of the jails throughout the country, evaded and ignored their provisions as far as they were able, so that during the next two decades many of the country prisons remained in a foul and unwholesome condition, both in their material structure and internal management, “fruitful sources of vice and misery, debasing all who were confined within their walls.” Meantime the system of transportation, which had been expected to act as a means of relieving the country of much of its criminal population, was becoming the source of great difficulties, both to the colonies and the home government. That it failed to act as a deterrent was evident from the appalling increase of crime which marked the first half of this century. A statistical writer, in a work issued in 1851 on the “Progress of the Nation,” pointed out that the number committed for trial in England and Wales was then more than five times as great as it was in the beginning of the century; that the proportionate increase in Ireland was still more serious, there having been in 1849 twelvelfold the number of committals that were made in 1805; while in Scotland, between 1815 and 1849, the increase in committals had been sevenfold. In England the number of persons committed for trial for indictable offences was only 4605 in 1805, and this number increased rapidly till, in 1842, it reached 31,309, of whom 21,738 were convicted. While the increase of population between 1805 and 1841 was in the proportion of 79 per cent., the increase of criminals was 482 per cent., so that serious crime had increased at a sixfold greater ratio than population. During the earlier portion of this period the death penalty had been retained for a large number of offences, and between 1805 and 1831 the number of offenders sentenced to death in one year rose from 850 to

1601. But as of the latter number only fifty-two were executed, it is obvious that the severity of these sentences was neutralized by their uncertainty, while the penalty of transportation imposed upon those who received a reprieve was, as we have said, very little feared by the convicts. Another serious defect in the system of transportation was its heavy cost, which amounted, when all the items of maintenance, cost of the passages out, cost of the military garrisons, &c., were included, to about £500,000 per annum. Of still greater importance was the fact that the free settlers and colonists had become strongly opposed to the convict system, and were loudly clamouring for its abolition, their efforts being supported also by an influential party in England. Several important committees had been appointed by the Houses of Parliament between 1831 and 1840, to consider the whole system of prison discipline, and one of these, appointed in 1837, freely and strongly condemned the transportation system. In 1840 orders were issued to suspend the deportation of criminals to New South Wales. In 1846 transportation ceased to Van Diemen's Land, and ultimately an Act was passed in 1857, by which sentences of transportation were abolished, and penal servitude substituted for them in all cases. Up to the year 1861, however (at which period the colony declined to receive any more), a small number of convicts were annually forwarded to Western Australia. A few were still sent to Bermuda and Gibraltar, and the practice was only finally abandoned in 1875.

The abolition of transportation rendered the establishment of a new system absolutely necessary, and under the direction of Sir George Grey the foundations were laid of the penal system which prevails at the present day. The points upon which especial stress was laid were (1) to insure for each convict a limited period of separate confinement, during which he should be subjected to hard labour, and should receive moral instruction; (2) that he should be afterwards employed upon public work at home or abroad; and (3) that he should be sent to one of the colonies to spend the period covered by his ticket-of-leave. The concluding portion of the new plan had to be abandoned owing to the opposition of the colonists, but the former portions were quickly carried into practice. New prisons were erected, and old ones, like Millbank and Dartmoor, were pressed into service, while important public works, to be carried through by convict labour, were commenced in 1847 at Portland, in 1852 at Portsmouth, and in 1856 at Chatham. The new plan proved in its working much more effective in the restraint of crime than the system it had superseded, and the improvement in the condition of the lower classes, brought about by the abolition of the Corn Laws and the removal of restrictions upon trade, together with the establishment of a more efficient system of POLICE, all tended to bring about a great diminution of national crime. The action of the legislature had been accompanied by noble philanthropic effort on behalf of the young, the friendless, and the ignorant, and the results in a few years proved greater than even the most sanguine could have anticipated. It will suffice here to say, that in the year 1834, when the population of the country was about 15,000,000, the convict population was about 50,000 in all. Of these 43,000 were in New South Wales and Van Diemen's Land; there were from 3000 to 4000 in the hulks waiting for shipment; several hundreds in the penitentiary at Millbank; about 900 at Gibraltar; and probably as many, or more, at Bermuda. We have now a population of nearly 27,000,000 and the number of our convicts is less than 9000, to which we may add some 2000 more of prisoners on ticket-of-leave. Nor is this diminution in the prison population confined only to the convict prisons, the decrease being equally remarkable in the local prisons throughout the entire country.

With the introduction of the new system of convict discipline, several efforts were made by prison reformers to obtain one good and uniform system, under government direction, for the whole of the country, but many years elapsed before this could be accomplished. Something was done in 1865, when an Act was passed consolidating all previous statutes relating to prison discipline, and promulgating minute and precise regulations on every item of prison management; but as with many other excellent laws, it was found impossible to reduce it to practice, owing to the opposition of those who had to be intrusted with the maintenance of its provisions. The different local authorities who had the control of the greater part of the prisons of the country, in the majority of cases, preferred their own rules to those of the Act; and in place of one equal system it depended very much upon locality whether a given sentence was a light or heavy punishment. The investigations made previous to the passing of the Prisons Act of 1877 showed that, independent of the eleven large government convict prisons, which had formed the model of similar continental establishments, there were in England 116 borough and county prisons supported by parochial rates and controlled by local authorities. This was an average of one gaol to every 440 square miles, and one to every 200,000 of the population. They were, however, very unequally distributed, and the contrast in the average number of inmates was very striking. In some gaols, such as those of London and Liverpool, the daily average was 1674, 1200, and 1016; on the other hand, the average in gaol in Rutland was five, and in Tiverton two! Under these circumstances there was necessarily great variation in the respective expense annually per head, which rose from £15 in one of the larger, to £150 per head in one of the smaller gaols. In some cases there was one officer to twelve prisoners, the average for a well-regulated prison being 10 per cent.; but in others there was, as a rule, more officers than prisoners—five officers, for instance, being maintained to keep watch and ward over the two prisoners at Tiverton. Perhaps the most important defect of all was that the treatment of the prisoners and the general internal discipline of the gaols was entirely at the caprice of visiting justices, whose theories varied from the most paternal indulgence to the keenest severity. In some gaols prisoners were kept at work for ten hours, and in others for only three; in some hard labour meant 14,000 feet of treadmill daily, or the breaking of 20 cwt. of stone, while in others it meant only 7000 feet of treadmill and 10 cwt. of stone. In some cases, where the average cost of a prisoner was about 1s. per day, the proceeds of his earnings reduced this by at least 3d. per day; in others his cost amounted to 6s. 6d. a day, and he earned nothing, his labour being of a strictly penal character. In one class of gaols the dietary was mainly designed to make the prisoner a capable worker; in the other it was regarded as in itself an instrument of punishment.

It was upon a review of these circumstances that in 1877 the government resolved to undertake the entire charge of prisons throughout the country, and the Prison Act of that year accordingly transferred all gaols from the control of the local authorities to that of the government, the cost of their maintenance being made an imperial, instead of a local charge. By this Act the management of all the prisons of the United Kingdom was placed under the control of the Home Secretary, who exercises his authority through a body of prison commissioners, invested with very extensive powers, and assisted by an important staff of inspectors and other officials. Local aid is not entirely dispensed with, the co-operation of the surrounding magistrates, so far as advice and assistance are concerned, being provided for by the appointment of visiting committees, who act under the rules and directions laid down by the Home Secretary. The new law took effect in April, 1878,

and within two years from that date the prisons had been reduced in number from 116 to 68; while the cost of their maintenance had been reduced from nearly £620,000 annually to about £460,000. In their report of 1881 the commissioners also pointed out that they had introduced a uniform system of treatment, discipline, and dietary throughout England and Wales; that they had paid special attention to the sanitary requirements of the prisons, with the result of reducing the death-rate 2 per 1000; that the number of suicides had diminished; and corporal and dietary punishments had been greatly reduced in number. Subsequent reports have further confirmed the wisdom of the step taken in 1878, and while, no doubt, much remains to be accomplished, there is good reason to hope that the prison discipline of Great Britain is at last established upon a sound and rational basis.

Having thus traced in outline the history of the convict system of Great Britain, we now proceed to consider its actual working at the present day. When a prisoner has been committed for trial by a magistrate he is placed by the police in one of the local prisons, where he remains until he is brought before a judge and jury at sessions or assizes. During this period of detention he is allowed to wear his own clothes, provide his own food, and make the necessary arrangements for his defence. If after his trial he is sentenced to imprisonment with hard labour, he undergoes a penal servitude he becomes a convict and undergoes his penalty in one or more of the convict prisons. During the term of imprisonment with hard labour a prisoner is kept in strict seclusion for the first month, during which he is, if able-bodied, employed upon the treadmill, upon the crank, in beating oakum, or in making mats with heavy implements. His diet is coarse and strictly limited, while he has also to sleep upon a plank bed without a mattress. If he is obedient and willing he may at the end of the month be passed into the second stage, in which he is allowed better diet and a mattress twice a week. A third stage, which may also be reached by good conduct at the end of another month, confers further privileges in the matter of diet and bed, and two further stages in the way of amelioration may be reached if the sentence is long enough. During the second and the three following stages the prisoner may earn a small gratuity, amounting in the aggregate to 10s., and he may even receive instruction in some useful form of labour. During the whole period he finds provision made for his moral and religious instruction, while his physical requirements in respect to warmth, ventilation, &c., are also attended to in accordance with a carefully studied and uniform system of prison management.

Two years is the maximum period allowed for the penalty of imprisonment simply, but the sentence to penal servitude may be for any period from five years to life. The administration of the sentence of penal servitude may be divided into three stages—(1) that passed in separate confinement in one of the "close" prisons, and which is limited to nine months; (2) a period spent in associated labour in one of the public works prisons; and (3) in the case of good conduct, a period of liberty subject to the conditions of a ticket-of-leave. During the first of these stages the prisoner has absolutely no communication with any one save governor, chaplain, warden, schoolmaster, or trade instructor, and sees no one save at prayers or at exercise, where any attempt at conversation is a breach of discipline. In the second stage he is passed, if able-bodied, to Chatham, Portland, Portsmouth, Borsal, or Chatterden, being in each case employed in quarrying, stone dressing, building, or some such labour. An important prison of this description will also be shortly opened at Dover, and the convicts will be there employed in the enlargement of the harbour and port. Convicts who are invalid or of a

weak constitution are passed to prisons like those of Wormwood Scrubs, or Dartmoor, where the lighter crafts of tailoring, shoemaking, mat-making, farm work, &c., are carried on. In either case the convict is still subjected to all possible moralizing influences, the work itself being not the least of them. He is also compelled to receive scholastic instruction if his education is below a certain standard, is often visited by the chaplain, is compelled to be cleanly in person and cell, to bathe regularly, and take exercise daily. With respect to the third stage, a certain amount of remission is fixed as the maximum which can be attained by perfect industry, and the number of marks is so regulated that a convict must obtain the maximum number of marks every day (without any deduction for misconduct), in order to get the maximum remission. The sentence, therefore, is absolutely fixed up to a certain point, but may possibly extend beyond that point, and will inevitably do so unless the convict persistently and strenuously exerts himself. The marks are given simply for labour done, the minimum being six, the maximum eight.

The maximum period of remission for male convicts is a fourth part of that portion of the sentence which remains after deducting nine months for separate confinement: i.e., for instance, a person sentenced to ten years could not possibly obtain a remission of more than two years three months and three weeks. The scale applicable to females is somewhat less stringent, and by good conduct and industry they may obtain the remission of a third of that portion of the sentence which remains unexpired after they have served nine months in separate confinement. By the Act of 1867, an important change was made in respect to the amount of gratuities allowed to convicts under their discharge, and the maximum which can now be earned by the greatest possible industry is £6, and is the same whatever may be the length of the sentence. By this means a defect in the former system was obviated—viz., that prisoners who were under the heaviest sentences, in consequence of the enormity of their offences, received the largest sums of money from the public upon the recovery of their freedom. They now have no more than is considered necessary to enable them to live honestly until they can be reasonably expected to procure employment. With respect to convicts sentenced to penal servitude for life, their cases are not now taken into consideration at all until they have been confined at least twenty years, when their cases may be brought forward and considered upon their merits. Nor must it be supposed that a convict recovers his full and entire liberty by the grant of a ticket-of-leave, or even by the expiration of his sentence. In the former case invariably, and in the latter case for any period at the option of the judge, after the expiry of sentence the convict is under the surveillance of the police, to whom he is bound also to report himself at stated times; and nothing exercises a more deterring influence over an old offender than the knowledge that the eyes of the police are ever upon him, that his actions are watched, and that any malpractices would be speedily discovered.

Disposal of Convicts.—Now that scarcely any convicts are sent abroad, their disposal after the termination of their sentence is, in England, one of the most difficult questions connected with punishments, and for its settlement no thoroughly satisfactory measures have yet been adopted or devised. The best solution of the problem seems to have been found by the Prisoners' Aid Societies, the first of which was founded in 1857, and which has assisted many thousand prisoners, though it has never yet received the amount of public support and encouragement it deserves, probably because of a rather widespread impression that the excellent work that the society undertakes belongs to the authorities themselves. For female convicts

there are two refuges, the Westminster Memorial Refuge at Streatham, for Protestants, and the East End House, Finchley, for Roman Catholics.

In conclusion, we may observe that the "Criminal Statistics," which are annually published by the government, afford some slight means of testing the results of the alterations made of late years in our treatment of criminals. It is impossible to deny that these statistics show considerable improvement, and it is evident that the prison discipline, in addition to its punitive character, does in many cases exercise a real and permanent reformatory influence. On the other hand, it is equally obvious that much yet remains to be done. While many of the prisoners, through the moral and industrial instruction received, come out of the prisons to earn henceforward honest livelihoods, there can be no question that others come out with a more thorough and complete education in crime and with a resolute determination to prey upon society to the full extent of their capacity. It is impossible to prevent conversation among men employed in associated labour, and it is found that old and hardened offenders often take a fiendish pleasure in instructing others who are less experienced in crime. Many a conspiracy to rob or swindle is first hatched within prison walls, and the prisoners find means to make alliances there for the carrying of their plans into execution after their release. Only those who are brought into daily contact with the criminals who form the population of our convict prisons, can form any estimate of the depths of shameless depravity in which many of them are sunk, and if we may trust the revelations made recently by some who have passed through some years of penal servitude, the prisons are still to some extent nurseries of crime and criminals. It is satisfactory to know, however, that this evil is fully recognized by those intrusted with the management of the prisons, and since 1880 a special class has been maintained for criminals "not versed in crime" as distinguished from "old offenders," and the two classes are kept as far apart as possible.

The reader who wishes to pursue the subject minutely will find abundant details in the prison blue-books published annually, and also in the reports of the various commissions which have been appointed from time to time to inquire into the subject. See also "An Account of the manner in which Sentences of Penal Servitude are carried out in England," by Sir Edmund Du Cane, K.C.B., R.E., (second edition, 1883); "The Punishment and Prevention of Crime," by the same author (1885); "Five Years' Penal Servitude," by one who has suffered it (1879); and "Convict Life," by a Ticket-of-leave Man (1879).

PRIVATEER, a vessel belonging to private individuals, sailing with a license (known as "letters of marque and reprisal") granted by a government in time of war to annoy and plunder the vessels of the enemy. The practice of privateering was formerly very much resorted to, and numerous laws and regulations concerning it were promulgated, but it was always liable to grave abuse, and in 1856 most of the European nations assented to the Declaration of Paris, of which the first clause runs—"Privateering is and remains abolished." This declaration binds only the powers who are signatories or who afterwards assented, and those only when engaged in war with one another. The United States of America, Spain, Mexico, and Uruguay have not acceded to it, and therefore its terms would not apply on either side in the event of a war between either of these countries and one of the parties to the declaration. During the American Civil War the president of the Northern States was authorized to issue letters of marque, and a similar power was used by the leader of the South, but as a matter of fact they were never issued by either side. It is a doubtful question how far this declaration would be observed in the event of a prolonged and embittered contest between any two naval

powers, and on more than one occasion its principle has been threatened since the treaty was made. Thus, during the Franco-German War of 1870 the Germans commenced the creation of a "volunteer fleet," and in the various controversies which have arisen between Great Britain and Russia, the latter power has always indirectly threatened to commission volunteer cruisers to prey upon British commerce. At the same time it is evident that a breach of the declaration on the part of a nation consenting to it would justify the nation against whom it was directed in refusing to recognize the rights of privateers, and to treat them as pirates.

PRIVET (*Ligustrum*) is a genus of plants belonging to the order OLEACEÆ. The species are shrubs or small trees, with opposite, entire leaves, and small white flowers in terminal panicles. The calyx is cup-shaped, deciduous, four-toothed; the corolla is funnel-shaped, four-lobed; the stamens are two; the fruit is a globular two-celled berry, each cell containing a single seed. The species are chiefly confined to China, Japan, and Northern India.

The Common Privet (*Ligustrum vulgare*) is a bushy sub-evergreen shrub, growing naturally in hedges and thickets in the south of England and Central and South Europe, and cultivated in other parts. It grows to a height of from 6 to 10 feet. In point of utility and ornament few shrubs exceed the privet. Its chief use is to form hedges either for shelter or ornament. It bears cutting well, and is not liable to be disfigured by insects. Having fibrous roots, it robs the ground less than almost any other shrub. It is one of the few plants that will grow in the smoke of London; it also thrives under the drip of other trees. The wood is hard and used by turners. From the pulp of the dark purple berries, which afford food to many birds, a rose-coloured pigment may be prepared; with the addition of alum, they dye wool and silk of a good durable green.

Ligustrum lucidum, a Chinese species, with shining broad leaves, is hardy in England, but does not fruit. Some other species have also been introduced into this country.

PRIVET MOTH (*Sphinx ligustri*) is a species of HAWK MOTH (Sphingidae), so called because the caterpillar feeds largely on the leaves of the privet. The privet moth is a large handsome moth, measuring about 4 inches across the wings, which are narrow and sharply pointed. The fore wings are pale brown, mottled with dark brown and black; the hind wings are pink, with three transverse black bands. The abdomen is rose-pink, barred with black. The caterpillar is large, green in colour, with white and purplish streaks on the sides, and a black horn on the back at the hinder extremity of the body.

PRIVILEGE (Lat. *privilegium*, from the sense of which, however, it has been perverted), a particular beneficial exemption from the general rules of law. Privilege is of two kinds—*real*, attaching to place; and *personal*, attaching to persons, as ambassadors, peers, members of Parliament, and attorneys.

Formerly many places conferred the privilege of freedom from arrest, even in criminal matters, upon those who entered them; and even in later times many places existed which privileged those within them from arrest in civil suits. Of these the most notorious were White Friars, the Savoy, the Mint, and other places in their neighbourhood. But by 8 & 9 Will. III. c. 27, the privileges of all these places were abolished. However, at the present time, no arrest can be made in the king's presence, nor within the verge of the Palace of Westminster, nor in any palace where he resides, nor in any place where the king's justices are sitting (8 Inst., 148). Personal privilege, which gives freedom from arrest, is enjoyed by all suitors, counsel, witnesses, or other persons attending any courts of record upon business, or an arbitrator under a rule of *Nisi Prius*.

This exemption is to be interpreted liberally, and will not, therefore, be forfeited by taking refreshments after a suit, or by going other than the direct road to or from a court. (Com. "Dig." tit. "Privileges.") The privileges of the members of the House of Peers and of the House of Commons are stated under PARLIAMENT.

PRIVY COUNCIL. From the earliest times the king of England has been guided in his public acts by the advice of a council, and during the mediæval period a series of courts arose out of this council, which were invested with very extensive powers. Among these were the courts of King's Bench, Common Pleas, and Chancery, the Council itself being regarded as a resort for justice in cases for which the constitution of the other courts did not provide. It was also the supreme administrative body, and from time to time its overweening power had to be restrained by special statute. An important enactment of this kind was passed in the reign of Edward III., and at a later period the Privy Council was prevented from meddling in civil cases and acting contrary to the ordinary laws by the 16 Charles I. c. 10. During the reign of William III. the political duties of the Privy Council were transferred to the cabinet, but the Act of Settlement (12 & 13 Will. III. c. 2) provided among other things that all matters relating to the government properly cognizable in the Privy Council were to be transacted there; and all the resolutions taken thereon were to be signed by such of the Privy Council as advised and consented to them. By 2 & 3 Will. IV. c. 92 the powers of the high courts of delegates, both in ecclesiastical and maritime causes, were transferred to the king in Council. The Council lost its probate appeal jurisdiction in 1857, its admiralty jurisdiction in appeals from England in 1875, from Ireland in 1877.

At the present day members of the Privy Council must be natural-born subjects of England, and they are nominated by the crown without any patent or grant. After nomination and taking the oath of office, they immediately become privy councillors. The Council usually includes the princes of the royal family, the principal members of the government, the archbishops, and the Bishop of London, the judges of the House of Lords, the judicial committee and the court of appeal, the Speaker of the House of Commons, the commander-in-chief, the ambassadors, many ministers plenipotentiary and colonial governors, the Vice-president of the Board of Trade, the President of the Poor Law Board, &c. Members of the Privy Council have the title of "right honourable," and in the order of precedence they rank next after knights of the Garter. The Lord President of the Council is the fourth great officer of state, and a member of the cabinet, with a salary of £2000 a year. The Privy Council of Scotland was merged in that of England by 6 Anne, c. 40, but there is a separate Privy Council for Ireland.

The duties of privy councillors, as stated in the oath of office, are—to the best of their discretion truly and impartially to advise the crown; to keep secret the royal council, to avoid corruption, to strengthen the sovereign's council in all that by them is thought good for the sovereign and the land; to withstand those who attempt the contrary; and to do all that a good counsellor ought to do unto his sovereign lord. There is no limit to the number of privy councillors who may be appointed, but according to the accepted usage no members attend the deliberations of the Council who are not especially summoned for that purpose.

The administrative duties of the Privy Council, which rest chiefly upon statute, are exercised either by the whole council or by committees to which matters are referred by the crown in Council. Among the various committees are the Board of Trade, the Committee on Education, the Local Government Board, and the Judicial Committee.

The functions of the latter committee are at the present day intrusted to the Lord President, the Lord Chancellor, the Lord Keeper, or first Lord Commissioner of the Great Seal, the Lord Chief-justice, Master of the Rolls, and such privy councillors as shall have held any of the above offices. To these were added by 34 & 35 Vict. c. 91, four paid judges, at salaries of £5000 each, but by the Appellate Jurisdiction Act of 1876 it is provided that as the present paid members die or retire they shall be replaced by the Lords of Appeal in Ordinary, who are life members of the House of Lords. The original jurisdiction of the Judicial Committee consists of certain powers conferred by the Copyhold, Patent, Endowed School, and other Acts. Its appellate jurisdiction, which is entirely regulated by statute, is very extensive, and appeals lie to it from the Arches Court of Canterbury, from a vice-admiralty court abroad, from the courts of India, the Colonies, the Channel Islands, and the Isle of Man. The proceedings in all cases begin by petition addressed to the crown in Council.

PRIVY SEAL. The Lord Keeper of the Privy Seal is a member of the cabinet, and has a salary of £2000 per annum. He is the fifth great officer of state, and must not put the seal to any grant without good warrant. The privy seal is that used by the king to all charters, grants, and pardons signed by him, before they come to the great seal.

PRIZE, property taken from an enemy. The term is generally applied to property taken at sea exclusively. The law of prize is regulated by the law of nations. Sentence of condemnation, that is, sentence that the thing captured is prize, and that consequently the property of its original owner in it is entirely divested, must be pronounced by a court of the capturing power duly constituted according to the law of nations. The prize court of the captor may sit in the territory of an ally, but not in that of a neutral. Questions of prize are by the English law disposed of in the Admiralty division of the High Court of Justice.

PRIZE-MONEY. All the Acts relating to army prize-money were repealed by 2 & 3 Will. IV. c. 53, which also enacts that all captures made by the army shall be divided according to such general rule of distribution as the king shall direct. Appraisements and sales of prize and capture are made by agents appointed by the commanders and other commissioned officers. A certified list of the persons entitled to share in the capture is transmitted to Chelsea Hospital by the commanding officer. There is a penalty of £500 for altering names. At the end of three months from the receipt of prize-money the treasurer of Chelsea Hospital is required to notify in the *London Gazette* and in two London morning papers that distribution will be made at the end of one month. In this notification the share of an individual in each class must be declared. Shares of prize-money due to a non-commissioned officer or soldier will be paid only upon his personal application, or to his wife or child, father or mother, brother or sister, or to a regimental agent. If discharged, a certificate must accompany the application, signed by the clergyman and one of the churchwardens or overseers. Personating or falsely assuming the name and character of a person entitled to prize-money with fraudulent intent is punishable with penal servitude. By 3 & 4 Vict. c. 65, the Privy Council was empowered to refer to the high court of Admiralty matters concerning booty of war (property captured by land forces). The prize court of the Admiralty division is the proper court for deciding on matters captured by naval forces.

PROBABILITIES, THEORY OF, a branch of mathematics in which arithmetic is applied to the calculation of chances, in cases in which the data are known. It is impossible in a work like the present to give full account either of the mathematical theory or of the various ways in which our independent judgments are confirmed or opposed by it.

The terms of this theory are well known in connection with games of chance, to which it was originally applied, and for which it was invented. A card being drawn at hazard from a pack, there are thirteen ways in which it may be a spade, and thirty-nine ways in which it may not. Hence it is said to be 39 to 13, or 3 to 1, against drawing a spade; and $\frac{1}{3}$ and $\frac{2}{3}$ are made to represent the chances of drawing a spade and of not drawing one. Reducing this to a formula, we say that if an event may happen in a ways and fail in b ways, and all these ways are equally likely to occur, then the probability of its happening,

$$\frac{a}{a+b}$$

and the probability of its failing, is $\frac{b}{a+b}$. Or if we know p , the probability of a thing happening, then $1-p$ is the probability of its failing.

When the probability of an event happening is to the probability of its failing as a to b , we say "the odds are a to b on the event," or, which is the same thing in converse, we say, "the odds are b to a against the event," as in the above illustration from cards, where the odds are 3 to 1 against drawing a spade.

If there are several equally likely events, $A B C D$, &c., and several ways in which they may occur, $a b c d$, but only one of these ways is possible at one time, then since by hypothesis A can occur in a ways, and fail in $b+c+d$ ways, the probability of A 's happening is $\frac{a}{a+b+c+d}$, for $(b+c+d)$ represents the b of the first formula arrived at. The probability of B 's happening is $\frac{b}{a+b+c+d}$, and so on.

An important application of the theory of probabilities is the preparation of tables of life insurance from the death returns of the registrar-general. These "tables are now tolerably numerous, each one being more accurate than its predecessors, since it is based on wider generalizations. Now, suppose it appears that only 6047 persons fourteen years of age live to be twenty-one out of a total of 6335 examined. Then we may say that since on the average one person is as likely to live as another, the probability that a youth of fourteen will attain maturity is $\frac{6047}{6335}$, and the probability that he will die before he comes of age is $\frac{288}{6335}$; or that the odds are 6047 to 288 in favour of his attaining maturity.

The following is another instance of the application of these principles which may be useful:—Let three white balls, four black balls, and five red balls be thrown into a bag. The probability that a white ball will be drawn by a person thrusting his hand into the bag is $\frac{3}{12}$, that of a black ball $\frac{4}{12}$, and that of a red ball $\frac{5}{12}$. What are the probabilities of a certain pair, say two white balls, being drawn? The number of pairs formable out of 12 is 66: the number of pairs formable out of the three white balls is three; therefore the probability of drawing two white balls is $\frac{3}{66}$; so also we find that of drawing two black balls to be $\frac{6}{66}$, and that of drawing two red balls to be $\frac{10}{66}$ (since ten pairs can be made out of five things). Further, as each white ball might be drawn with a black ball, the total number of pairs, one white and one black, is $3 \times 4 = 12$; therefore the probability of drawing a pair composed of one white and one black ball is $\frac{12}{66}$. Similarly that of drawing one black and one red ball is $\frac{20}{66}$, and that of drawing one red and one white ball is $\frac{15}{66}$. These are the only six ways of forming pairs: and since adding all the fractions together unity results as their sum, the truth of the calculation is proved.

The subject is interesting, but the limits of the present work forbid the discussion of problems of any greater perplexity than the one given above. We may, however, give a very useful formula to find the probability of any even

happening exactly r times in n trials, if we know the probability of its happening in one trial (say the throwing of a die to turn up ace, for example). Let p be the probability of success, and q the probability of failure, then $q=1-p$, as before said. The formula is

$$p^r q^{n-r} \frac{n(n-1)(n-2) \dots (n-r+1)}{1.2 \dots r}.$$

Apply this formula to this problem: In five throws with a single die what is the probability of throwing ace exactly three times? Here $p = \frac{1}{6}$, $q = \frac{5}{6}$, $n = 5$: and the formula works out thus—

$$\left(\frac{1}{6}\right)^3 \left(\frac{5}{6}\right)^2 \times \frac{5.4.3}{1.2.3} = \frac{125}{888},$$

which is the probability required. Three aces out of five throws will come 250 times in 7776 trials.

But supposing we want to know at least how many times three aces will come (which permits four aces, or even five aces, to occur, and does not limit us to only the exact three), then the answer is given by the sum of the probabilities of its happening every time, of its failing once, failing twice, &c., up to failing $n-r$ times, all added together. The formula is

$$p^n + n p^{n-1} q + \frac{n(n-1)}{1.2} p^{n-2} q^2 + \dots$$

$$\text{up to } \frac{n(n-1)(n-2) \dots (r+1)}{1.2.3 \dots n-r} p^r q^{n-r},$$

and the working out with the above data gives

$$\left(\frac{1}{6}\right)^5 + 5 \left(\frac{1}{6}\right)^4 \frac{5}{6} + \frac{5.4}{1.2} \left(\frac{1}{6}\right)^3 \left(\frac{5}{6}\right)^2 = \frac{276}{7776}.$$

That is, the chance of at least three aces turning up in a group of five throws of one die is 276 times in 7776 trials. These formulas serve to work out a very large number of the most usual "odds," and will reveal the most startling unfairness in many apparently fair chances. Their application to betting on races, or to such games as rouge et noir, roulette, &c., is attended with the healthiest results. Professional bookmakers or croupiers are found to have very comfortable odds on their own side, while appearing to deal fairly with their victims.

PROBATE AND LEGACY DUTIES. Every will of personal property must be deposited in the Probate, Divorce, and Admiralty divisions of the High Court of Justice, a copy thereof being given to the executor. This copy is called the probate, and the application made for it or for letters of administration must be accompanied by the payment of the probate duty levied upon the whole value of the personal estate left by the deceased. The following is the scale at present:—Estates above £100 in value, and not exceeding £500, £1 for every £50 or fraction of £50; estates above £500 and not exceeding £1000, duty at the rate of £1 5s. for every £50 or fraction of £50; and for estates exceeding £1000 in value, £3 for every £100 or fraction of £100. Estates that do not exceed £100 in value are exempt from probate and legacy duties. Formerly probate duty was much higher when letters of administration were taken out than when a will was proved, but this distinction between testate and intestate estates was abolished by an Act passed in 1880, and a new scale of duties was authorized, under which large estates are charged their due proportion of the amount always paid by small ones. Legacy duty is charged on all legacies of the value of £20 and upwards, which are paid out of personal estate, or charged upon real estate, and upon every share of residue. Legacy to a husband or wife is exempt from duty. To a child or parent, or any lineal descendant or ancestor of the deceased, the duty is £1 per cent.; to a brother or sister

or their descendants, £3 per cent.; to an uncle or aunt or their descendants, £5 per cent.; to a great uncle or great aunt or their descendants, £6 per cent.; to any other relation or any stranger in blood, £10 per cent. In 1850 the amount of the probate and legacy duty was £2,248,206. In 1886 the amount had increased to £4,103,644. See also SUCCESSION DUTY.

* **PROBOSCIDEA** is an order of MAMMALIA containing the elephants and their extinct allies, the mastodon and dinotherium, included by Cuvier in his order Pachydermata. The dentition in this order is remarkable. The molar teeth are few and are shed in succession, there being never more than one and the anterior portion of another on each side of each jaw at the same time in the elephants. The dinotherium, however, has two premolars and three molars on each side of each jaw; and the species of mastodon occupy an intermediate position between the two genera. There



Vertical Section of the Skull of the Elephant.

are no canines. Two incisor teeth are present in the upper jaw in the elephants, composed entirely of ivory, a modification of dentine, and developed into long tusks; the mastodons have generally small tusks in the lower jaws also, while the dinotherium has two long curved tusks in the lower jaw and none in the upper. The skull is very large, owing to the development of air-sinuses, but the brain-cavity is small. The flexible proboscis or trunk with which these animals are furnished is a prolongation of the nose, having the nostrils situated at its tip. There are no clavicles. The placenta is zonary and deciduate.

Of this order there are only two species still extant—one, *Elephas indicus* [see Plate], found in India and other parts of Southern Asia, and the other, *Elephas africanus*, inhabiting Africa south of the Sahara. In former times, however,

the order was spread over nearly the whole of the world. Species of the genus *Elephas* were living in Britain and on the continent of Europe in Pliocene times, and one of them, the MAMMOTH (*Elephas primigenius*), which extended over the whole of the northern hemisphere, was a contemporary of prehistoric man. The genus Mastodon was represented in Europe, Southern Asia, and America in the Pliocene age, and survived in the last-named continent into late Pleistocene times; remains of *Mastodon arvensis* have been found in the crags of Norfolk and Suffolk. The genus Dinotherium differs most from the living elephants, and occurs in Miocene formations in Europe and Northern India. See ELEPHANT, MASTODON, DINTHERIUM.

PROBOSCIS MONKEY (*Semnopithecus nasalis*) is a singular species of monkey belonging to the family SEMNOPITHECIDÆ, and inhabiting the great island of Borneo. The male of this monkey possesses a very long fleshy nose, which looks like a caricature of that organ in the human species; it is naked, reddish-brown in colour, straight, with the tip slightly bent downward, and the nostrils opening underneath. In the female it is much smaller and terminates in a point. The body of this monkey is long, with long arms and legs, and a very long tail. The hair of the head and back is of a chestnut colour, which becomes lighter on the rest of the body. The face is naked, of a pale reddish-brown or flesh-colour, and the ears are small. The male has whiskers extending round the cheeks to meet a little beard which curls up under the chin and sticks out slightly, like that of a goat. The thumb of the hand is very short, scarcely reaching as far as the first joint of the fingers. The stomach is compound, and there is a large air-sac in the throat.

The proboscis monkeys live in large troops upon the trees in the neighbourhood of swamps. They display most activity in the morning and evening, when they may be seen leaping with great force and rapidity from tree to tree, clearing a distance of 15 or 20 feet with ease. The natives of Borneo call this monkey the Kala, which is an approximation to the sound it utters.

PROBUS, MARCUS AURELIUS, Emperor of Rome, was born at Sirnium, served early in the army, and was made tribune by the Emperor Valerian. He also served with distinction under Gallienus, Claudius II., Aurelianus, and Tacitus. The latter, after his exaltation, wrote to Probus, saying that he considered him as the main prop of the state, and at the same time gave him the command of all the legions in the East. When Tacitus died, six months after his assumption of the empire, his brother Florian was proclaimed emperor in the West, while Probus was proclaimed in the East; but in less than three months the former was put to death by the soldiers, and Probus was acknowledged universal emperor. He was then forty years of age. His reign was made illustrious by brilliant military achievements along almost the whole frontier of the empire, continued till peace had everywhere returned. Probus encouraged the cultivation of the vine in Gaul and in Pannonia, and was continually engaged, when possible, in works of useful constructions, often using his soldiers for these purposes. The soldiers resented being made workmen of. An insurrection having consequently broken out in his camp near Sirnium, Probus took refuge in a building which he had constructed as a watch-tower, but being followed by the mutineers, he was killed, in 282. Vopiscus ("Historia Augusta") has left a high eulogium upon him, and indeed he seems to have been one of the best of the Roman emperors. He reigned six years and four months, and was succeeded by Carus.

PROCES VERBAL, a French term which signifies a memorandum or instrument drawn up and attested by officers of justice, containing a statement of the circumstances which have taken place upon the execution of a commission, upon an arrest, upon a precognition or pre-

liminary examination of the party accused, or in the course of other legal investigations, and set forth in the order in which they have occurred. The term is now frequently applied to a contemporaneous detailed minute or note of any formal proceeding, though not occurring in the course of any legal inquiry; for instance, a note of the discussions which are taking place during the negotiation of a treaty.

PROCESS. This term is sometimes used in its original sense as comprehending the whole of the proceedings which take place, and are recorded by the court, in the course of a suit, criminal or civil, previous to final judgment. In this sense the word (Lat. *processus*; Fr. *procès*) is also used in the French and the Scotch law. In its more ordinary and limited signification the term is applied to the writs which issue out of any court for the purpose of compelling the parties to a suit, and other persons whose co-operation is required, to do some act connected with the progress of the suit. In this sense, also, process is either civil or criminal.

Civil process was formally, and until lately practically, divided into original, mesne (intermediate), and final process.

Original process, more commonly known as original writs, issued out of the common law side or department of the Court of Chancery. Mesne process was that which issued between the original writ and final judgment, including writs issued for the purpose of compelling the attendance of jurors and of witnesses, and for other collateral purposes. Final process comprehended writs of execution.

At the present day a writ of summons is now the universal means of compelling the appearance of a defendant adopted in the High Court of Justice. In criminal matters process only applies where the defendant does not appear upon summons or otherwise, and it now usually takes the form of a warrant. By a recent Act, 44 & 45 Vict. c. 24, process of an English court of summary jurisdiction may be served in Scotland, and *vice versa*, and the rules of the Supreme Court (Ord. xi, 1883) provide in certain cases for the serving of a writ of summons out of the jurisdiction of the High Court of Justice.

PROCLAMATION. By the constitution of England the king possesses the prerogative of issuing proclamations; for although this authority is exercised by the lord mayor in the city of London, and by the heads of some other corporations in other cities, for certain limited purposes, it is always founded upon custom or charter, and consequently only exists by delegation from the crown.

In some instances proclamations are merely a promulgation of matters of state or of acts of the executive government. Proclamations of the accession of a new king or a demise of the crown, and proclamations for reprisals upon a declaration of war with a foreign state, and for rendering coin current within the realm, are examples of this kind. Another class of proclamations consists of those which declare the intention of the crown to exercise some prerogative or enforce the execution of some law. Thus the king might, by proclamation in the time of war, lay an embargo upon shipping, and order the ports to be shut, by virtue of his ancient prerogative of prohibiting any of his subjects from leaving the realm. A breach of the duty imposed or declared by a proclamation of this kind would be punishable, either as a contempt or as a misdemeanor at common law. Another class of proclamations issued by the crown consists of formal declarations of existing laws and penalties, and of the intention of government to enforce them, designed, as some of the early books term it, *quoad terrorem populi*, and merely as admonitory notice for the prevention of offences.

At present the royal prerogative does not authorize the creation of an offence by proclamation which is not a crime

by the law of the land: in the language of Sir Edward Coke (3 "Inst." 162), "Proclamations have only a binding force when they are grounded upon and enforce the laws of the realm."

PROC'NE, PROC'LUS, PROCO'PIUS, PROC'RIS. See PROKNE, PROKLOS, PROKOPIOS, PROKRIS.

PROCTER, BRYAN WALTER, an English poet and miscellaneous writer, better known by his *nom de plume* of Barry Cornwall, was born 21st November, 1787, either in Wiltshire or London. He received his early education at Harrow, where he had for his contemporaries Lord Byron and Sir Robert Peel, and was afterwards placed in the office of a solicitor at Calne, Wiltshire, where he remained until 1807, when he returned to pursue his legal studies in London. By the death of his father in 1816 he became possessed of a small property and began business as a solicitor, but he afterwards read for the bar, to which he was called in 1831. In 1832 he was appointed metropolitan commissioner in lunacy, an office which he sustained until 1861. He died in London 4th October, 1874.

His first contributions to literature were a series of poems which appeared in the *Literary Gazette*, and he afterwards published "Dramatic Scenes and other Poems" (1819); "Marcella Colonna" (1820); "A Sicilian Story" (1820); "Mirandola," a tragedy performed at Covent Garden in 1821; "The Flood of Thessaly and other Poems" (1823); and "English Songs and other Poems" in 1832. He was also the author of "Effigies Poeticae, or Portraits of British Poets" (1824); "Life of Edmund Keat" (1834); "Essays and Tales in Prose" (1851); and a "Mémoir of Charles Lamb" (1866). A fragment of an autobiography, with notes of his many literary friends, was published in 1877. As a poet he owed more to his studies among the works of his predecessors than to any original genius, but he possessed a graceful method of expression, and a delicate fancy which show to the best advantage in his lyrics.

ADELAIDE ANN PROCTER, daughter of the preceding, was born in London on 30th October, 1825, and at an early age displayed the possession of considerable poetical talent. Her "Legends and Lyrics," which appeared in 1858, ran through nine editions in seven years, and a second series, issued in 1860, was almost equally successful. Many of her songs were set to music, and in this form they have become established favourites. Miss Procter, who was an earnest philanthropist, became during the later period of her life a convert to Roman Catholicism. She died in London on 2nd February, 1864.

PROCTOR, a shortened form of the Latin term *procurator*, is the name given at the Universities of Oxford and Cambridge to two masters of arts nominated yearly by the colleges in rotation, who are charged with the maintenance of the college discipline among the undergraduates. Their authority, which is exercised either directly or through their deputies, the pro-proctors, extends to the townspeople as well as the students, and by virtue of their office they possess votes in the election to several professorships and other offices.

Proctor is also the title given to representatives of the clergy in convocation—either of the chapter of a cathedral or of the beneficed clergy of a diocese. Formerly the term was also used to designate certain officers in the ecclesiastical courts who were licensed to act as agents or attorneys for clients, and who possessed the exclusive right to practise there. By recent legislation, however, the exclusive privileges of the proctors were abolished (the existing officers being duly compensated), and now the business formerly confined to them is open to all solicitors. The office of the QUEEN'S PROCTOR is elsewhere described.

PRO'CYON (Gr. *prokuôn*, i.e. before the dog, the star which rises before the dog-star, Sirius), a star near Sirius, called α (alpha) in the constellation Canis Minor. Four

of the most splendid stars are curiously close: Sirius (Canis Major) being brightest of all stars; Procyon (Canis Minor), eighth in brightness; and Rigel and Betelgeux close by (in Orion), being respectively the fifth and ninth in order of brightness. Canis Minor is found in the Northern Hemisphere of our Plate CONSTELLATIONS, close to the word JULY; Canis Major, near the same word in the Southern Hemisphere. For the myth relating to Procyon see IKARIOS.

PRODIKOS (Lat. *Prodicus*), one of the Greek Sophists, was born in the Island of Cos. He was a friend and contemporary of Sokrates, and flourished about 435 B.C. He is spoken of with respect by Plato; and Xenophon, in his "Memorabilia of Sokrates," has handed down to us as the work of Prodikos the celebrated moral apologue entitled "The Choice of Heraklès." Heraklès being called upon by two females, the one of whom was clothed with modesty and propriety, and the other adorned with meretricious allurements, to choose between a life of labour and a life of pleasure, makes election in favour of the former, and thus wins for himself immortal glory, although by the sacrifice of all those enjoyments which, in the estimation of meaner men, are alone worth living for. Prodikos was identified with the Sophists in so far as he taught for payment, and proposed to teach those useful accomplishments by which men might raise themselves in the world. He seems to have differed from the other Sophists in the greater purity and elevation of his moral doctrines.

PROFIT is defined by the most recent English and American, as well as continental economists, as that part of the total produce of industry which falls to the share of the employer or *entrepreneur* who organizes and conducts production. The early English economists in their analysis of production treated of the gross product as divided only into three parts, rent, wages, and profits, defining the last as the surplus remaining to the capitalist after the other claims had been paid. This definition involves an identification of capitalists and employers which, however much it may have been justified by the facts of industry when Ricardo and McCulloch wrote, is by no means applicable to the highly organized industrial system of the present day, more especially in England and the United States. Mill, it is true, analyses profit into interest, risk, and "wages of superintendence," but in his argument he sometimes seems to lose sight of these distinctions. Professor Sidgwick deals much more fully with the growing separation between capitalist and employer.

Mr. F. A. Walker, the well-known American economist, in his "Political Economy" (1883), lays great stress on the importance of the entrepreneur's function in our highly developed industrial organization. He says—"In the later stages of industrial development the mere possession of capital no longer constitutes the sole, or even the main qualification for employing labour; and, on the other hand, the labourer no longer looks to the employer to furnish merely food and tools and materials, but to furnish, also, technical skill, commercial knowledge, and powers of administration; to assume responsibilities and provide against contingencies; to shape and direct production, and to organize and control the industrial machinery. So important and difficult are these duties of the entrepreneur, so rare are the abilities they demand for their satisfactory and successful performance, that he who can discharge these will generally find the capital required. It is no longer true that a man becomes the employer of labour because he is a capitalist. Men command capital because they have the qualifications to employ labour. To men so endowed capital and labour alike resort, for the opportunity to perform their several functions and to entitle themselves to shares of the product of industry."

Professor Walker then goes on to develop with great skill his original and ingenious theory, that "profits, the

remuneration of the entrepreneur, partake very largely of the nature of rent, being a species of the same genus; and that so far as this is the case, profits do not form a part of the price of the products of industry, and do not cause any diminution of the wages of labour." After pointing out with great force the almost world-wide ability among those engaged in the conduct of business—from "those rarely-gifted persons who, in common phrase, seem to turn everything they touch into gold," down by degrees to the multitude of men "who are found in the control of business enterprises, for no very good reason that can be seen by those who know them; men of chequered fortunes, sometimes doing well, but more often ill"—Professor Walker describes these last as the "no-profits" class of entrepreneurs, corresponding to the no-rent lands considered in the theory of RENT, and claims that the bare subsistence earned by them constitutes that minimum which, in economics, we can treat as *nil*, and from which profits are to be measured.

The price of manufactured goods of any particular description is determined by the cost of production of that portion of the supply which is produced at the greatest disadvantage, since, in any one market, at any one time, there is but one price for different portions of the same commodity. If the demand for such goods is so great as to require a certain amount to be produced by employers whose efficiency is small, the price must be high enough to yield them that amount of subsistence which has been taken as the no-profits line. The higher that price is the higher will be the profits of the skilled entrepreneur, who will be equally able to command it although the cost of production may in his case have been much lower.

It follows from what has been already stated that the excessive profits sometimes complained of can, except in the case of monopolies, only be reduced either by a reduction in the demand, which shall exclude the less efficient employers, or by the development of a large number of more equally gifted ones.

Our space will not permit anything like a full discussion of Professor Walker's very interesting and important theory, which will, however, be found fully dealt with in his "Political Economy," part iv., chap. 3.

PROGNOSIS (Gr. *pro* and *gnosis*, knowledge), in medicine, is the opinion formed respecting the probable future events of any malady.

PROGRAMME (Fr., from Gr. *programma*), a term originally adopted by the universities to signify an outline of the orations to be delivered on any special occasion, but employed in a more general sense as the scheme of any private or public entertainment, especially of a concert. (The word is sometimes spelt "program," on the analogy of "telegram," &c.)

Programme Music is the title given to instrumental music which seeks to tell a story, or illustrate a programme, or depict a scene by the sheer power of sound unassisted by words. It includes, according to some musicians, all imitative pieces, whether vocal or instrumental, such as songs which imitate trumpet calls or the cries of birds, &c. But without extending it to this point, and still less, as many do, seeking to include in the term all descriptive and dramatic music whatever (which is far too wide a classification, since all good music must be appropriate, and to that extent dramatic), there is yet a large field of what every one would admit to be programme music proper. It is a very antique practice, and was as much followed in mediæval times as now. In Queen Elizabeth's "Virginals Book" we find a piece professing to successively portray "Fine Weather," "Lightning," and "Thunder." These having been repeated several times in various orders, this chequered climate settles down after thirteen changes into "A Faire Day," as a sort of coda. Byrd's "Battle," by the good old music-master of the great queen, is another very de-

finite piece of programme music preserved at Christ Church, Oxford, and gives the reveillé, the foot march, the horse march, the trumpet calls, and so forth, very distinctly. Of modern composers Beethoven is the great exemplar in the composition of programme music, and he has left it on record that he rarely worked without a definite poetical thought, which he expressed in his music. It needs not that the same definite thought should occur to the hearer as to the composer, and, indeed, only in one great instance (the "Pastoral" symphony) has he given a complete clue to his meaning. Beethoven depicts certain intimately related states of feeling, and the same exquisitely subtle relationship is evoked in the mind of his hearer; but it is possible that the music expressing a prayer for liberty, followed by a thanksgiving, to the mind of the author, may call forth to the mental vision of the hearer a battle-cry and a victory, or a love-passion and a burst of joy. It matters little; the emotion is everything; the specific cause of the emotion may and must differ. Berlioz, however, pushed beyond the delicate feeling of Beethoven, to the ultimate limit of programme music. He aimed at telling definite tales. Liszt, his greatest successor, in his "Mazeppa" and its many companions, has gone to the verge of the impossible, straining after tone-pictures, trying to twist the ear into the service demanded of the eye. Spohr's "Power of Sound" symphony, Raff's "Lenore" and "Forest," Rubinstein's "Ocean," Sterndale Bennett's "Paradise and the Peri" overture, present examples of less ambitious and far more successful attempts at programme music.

Many composers now follow the fancy of old Couperin, who named his harpsichord pieces by suggestive titles long ago, and having worked out some characteristic musical thought call it by a definite name, which helps towards the understanding of it. Schumann was a consummate master of this art: his titles are deliciously appropriate. Stephen Heller was also very clever at giving titles, and he even ventured to "christen" all Mendelssohn's "Songs without Words," to the great horror of musical purists, but the great pleasure of simpler folk; for it is quite undeniable that the desire for programme music as against music which suggests no story and paints no picture, is growing so fast as to threaten to become universal. Dilettante critics, following the popular bent, are frequently found vainly endeavouring to find a tale in one of Bach's fugues.

PROGRESS (from Lat. *progressus*), the old term applied to the state journeys of our sovereigns, which, in the reigns of Elizabeth and James, were numerous and splendid, but often attended with heavy expense to the persons favoured by the royal visits. The custom was revived on a less costly scale in the early years of the present reign.

PROGRES'SION (Lat. *progressio*). A series of numbers following any law should be called a progression, but the word is usually restricted to three sorts of progression, which are called arithmetical, geometrical, and harmonical progression. See ARITHMETICAL PROGRESSION, GEOMETRICAL PROGRESSION, HARMONICAL PROGRESSION.

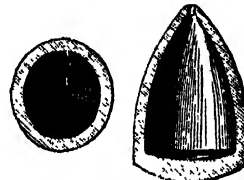
PROJECTILE (Lat. *projicio*, I throw forward), in a general sense, means any object intended to be thrown, but in gunnery any object intended to be projected from firearms. Prior to the invention of gunpowder many powerful mechanical appliances were used [see ARTILLERY], but they were gradually superseded by the new invention, just as gunpowder itself is, for certain purposes, being superseded by nitro compounds.

The resistance which a projectile encounters from the air depends partly on its shape and partly on its speed. [See GUNNERY.] Smooth-bore guns can only throw spherical projectiles successfully, for elongated ones would not travel point first, and thus would be deficient in range and uncertain in direction. Spherical projectiles are also

uncertain in direction, as they cannot be made to fit the gun tightly; they therefore rebound from side to side as they pass down the bore of the gun, and, on leaving the muzzle, bound away from the side last touched. This last touch also imparts a spinning motion to the projectile, which, together with slight variations in the shape and specific gravity of different parts of the projectile, prevents its travelling in a perpendicular plane. The advantage of this form of projectile is, that very little of its surface touches the bore of the gun; there is thus little friction and strain, and the projectile accordingly leaves the gun with a very high initial velocity, which, however, it soon loses, owing to the very large surface which it presents to the resistance of the air.

Elongated projectiles can be made to travel point first, by causing them to rotate on their longer axis, and as, of course, their weight is several times greater than that of spherical projectiles of the same diameter, they retain their momentum longer. At first inventors tried to cause their projectiles to rotate either by the action of the gunpowder upon grooves cut in the projectile, or by the action of the atmosphere upon wings, with which the shot was provided, or upon spiral perforations in the body of the shot; but it was soon found that the only satisfactory method was to cause the projectile to mechanically fit the bore of the gun; which was either grooved or twisted so as to force the shot to rotate while passing along it. This has been done in several ways—

(1) The bore of the gun was made smooth, but of peculiar form (not cylindrical), and the projectile was made to fit it mechanically. Of this class are the Lancaster and the Whitworth guns; in the former the bore has an



Lancaster's Oval Shell.



Whitworth's Hexagonal Shot.



Section.

oval section, and in the latter it has practically a hexagonal section; both projectiles are elongated, and have the same section as the bore, so that they fit it and receive a spinning motion in passing down it as the bore is twisted spirally.

(2) In 1846 a Swedish nobleman (Baron Wahrendorf), and a Sardinian artillery major (Cavalli) simultaneously suggested elongated projectiles with two spiral projecting ribs on their surface, corresponding to spiral grooves cut in the bore of the gun, which thus imparted the necessary rotation to the shot. These were the prototypes of a very numerous class of projectiles, which had two or more rows of projecting studs (instead of ribs) on their surface. This was the system first adopted for British rifled guns, and on which very many of our muzzle-loading guns are constructed. See PLATE I.

(3) In 1848 Captain Minié proposed his celebrated rifle bullet, which had in its base a cavity, in the mouth of which there was a small iron cup; the shock of explosion drove the cup into the cavity, where it acted as a wedge, and expanded the bullet into the grooves of the gun. A somewhat similar plan was proposed by Mr. Britten for heavy iron projectiles, the base of which he enveloped in lead. But this application to heavy gun projectiles was eclipsed by a still more ingenious American method, by

which a saucer-like brass ring was fastened to the base of the projectile; the shock of explosion flattened it out, thus increasing its diameter and making it expand into the rifling of the bore, while at the same time it was crushed

belts of soft metal, lead or copper, &c., which are fitted into rings cut in the shot and project slightly beyond its surface. The guns are rifled with a great many shallow and sharp grooves, and when the shot starts they cut into the soft rings, and thus make the shot rotate as it passes down the bore. See Plates I. and II.

Smooth-bore shots tend to leave the gun with a spinning motion, which varies with every shot, but the rotation of projectiles fired from a rifled gun is, of course, always the same, so that although the path of the projectile does not lie in a perpendicular plane, the amount of its lateral deviation or "drift" is easily ascertained and allowed for in adjusting the sights of the gun. British guns have a right-handed rifling — i.e. viewed from the rear the rifling on the upper side of the bore turns to the right, while that on the lower side turns to the left; the result is that, as the lower side of the projectile bears most heavily on the atmosphere, it tends to roll on it and to deflect to the right of the direction in which it started.

There are many different kinds of projectiles designed for different uses. Smooth-bore guns fired solid spherical balls at long ranges, and grape shot or canister at close quarters. Subsequently common shell were invented, and in the beginning of the present century the genius of General Shrapnel gave us the Shrapnel shell, one of the most universally used and deadly of projectiles.

Modern projectiles may be classed in five groups:—

1. *Common Shell* (see Plate I.)—These are hollow cast-iron or steel cylinders with a conoidal or ogival head. They are filled with gunpowder, and in their point is placed a fuze which explodes them at the proper moment. They depend for their effect more upon the amount of powder

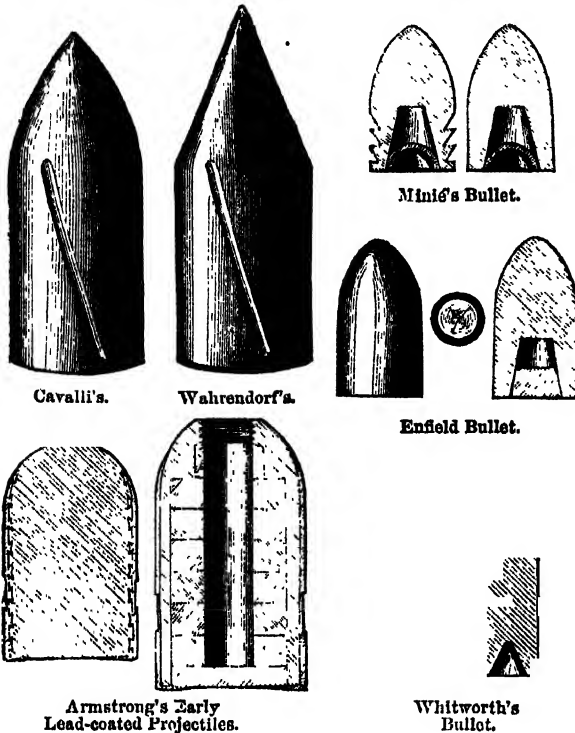
they contain than on the force with which they strike an object; thus they can be used up to the extreme range of the gun. They are used against *matériel*, large bodies of troops, or troops behind cover.

2. For penetrating iron or steel armour, either a heavy steel shell or the *Palliser* cast-iron shell is used. These projectiles are much thicker than common shells, and in the Palliser shell the point is of extreme hardness, being cast in chill. In armour-piercing shells the cavity for the powder is comparatively small, and the point is solid, the powder being introduced through the base (see Plate II.) This shell does not require a fuze, for the shell breaks up on the shock of impact, and the heat thus generated suffices to explode the powder.

3. *Shrapnel Shell* (see Plate I.) are used against the *personnel* of the enemy, such as troops in the open, &c. They consist of a hollow cylindrical body with an ogival or conoidal head: in the interior near the base there is a small charge of powder, immediately above this there is an iron disc, and between this disc and the head the body is filled with spherical bullets. The fuze is fixed in the point and communicates with the powder or "bursting charge" through a channel passing down the centre of the shell, and is timed to explode it during its flight, and in front of the object. The bursting charge is only strong enough to open the shell and release the bullets, which fly forward, and depend for their force upon the speed at which the shell is travelling when they are released.

4. *Case Shot* (see Plate I.), like the older *canister*, are, in different countries, iron, zinc, or lead bullets, packed in cylindrical metal cases, and intended for use at close quarters.

5. *Segment Shell* have a thin cast-iron outer case, inside



against projections on the base of the projectile, so that the projectile was forced to rotate with it.

(4) In 1854 Mr. Armstrong submitted for trial some breech-loading guns, in which the shot was enveloped in a soft lead coating, and was actually larger than the bore of the gun, so that the powder, when exploded, had to change the shape of the projectile by forcing the lead coating into the grooves of the gun.

In addition to securing the rotation of the projectile, the last two systems achieved a most valuable result in preventing the escape of gas past the shot while in the bore. They thus not only got more work out of the powder, but also prevented very serious damage to the bore by erosion. To secure a similar result, studded projectiles had saucer-like discs, called gas checks, fixed to their bases, with the concave face turned to the rear, so that on the explosion



Old Grape, New Grape, and Canister.

they flattened out like the brass rings mentioned above. The method now adopted with breech-loaders in most countries to prevent the escape of gas over the shot and to centre and impart rotation to it, is to encircle it with

which are built rows of cast-iron segments round a longitudinal central chamber, which contains a large bursting charge. They are a sort of pass between common and Shrapnel shell, and were issued with the original Armstrong breech-loading guns; but their manufacture has been discontinued in Britain, although a somewhat similar shell is used as common shell by the artilleries of France, Germany, and the other European powers (see Plate I.)

Besides the regular forms of projectiles, each country has one or more peculiar kinds which it has adopted. The Germans use incendiary shells, which contain cylinders of a highly inflammable substance; the French have shells divided into two compartments, the front one to contain powder, and the rear one bullets like Shrapnel; while the Italians have an armour-piercing solid shot of forged steel.

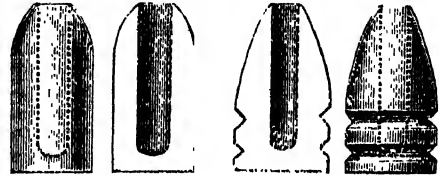
The employment of shells dates from a very early period. They are said to have been used at Naples in 1495, and at several other places between that period and 1542, when they were employed at the siege of Boulogne. At the bombardment of Genoa in 1684, shells were thrown of 1320 lbs. weight.

Rockets were known to the Chinese long before their introduction into European warfare. We first hear of their employment in Europe in 1379, by the Paduans and Venetians, who probably learned the secret of their manufacture through the commercial intercourse which they obtained with the East. But a serviceable war-rocket was unknown to the artillerists of Europe until Sir William Congreve invented his celebrated projectile, which, however, has many opponents who deny its usefulness and assert that it is positively dangerous from its wayward habits. It is furnished with a stick like common rockets, and thus its direction is greatly influenced by the wind. A war-rocket, introduced by Mr. Hale, is constructed with a special view to regulating its accuracy of flight and causing it to rotate, and so dispensing with the usual appendage of the stick. This is secured by streams of gas, which are made to escape from tangential apertures in a line with the axis of the projectile, and to act upon curved projecting surfaces placed in the same line as the holes.

With the view of throwing light upon the operations of a hostile force, Colonel Boxer invented a very ingenious projectile which he called a parachute light. It is built

between the paper shell and the tin case to receive a small charge of powder. When the shell has attained its proper elevation, the fuze fires the bursting charge of powder; the paper shell is split in halves, which fall away at once; the light-giving composition is simultaneously ignited, and as the case which contains it falls a little, the parachute quits its tin envelope, and at once unfolds. For British siege and mountain guns shells are now constructed containing magnesium stars, which ignite on the bursting of the shell and fall slowly, giving a very powerful light.

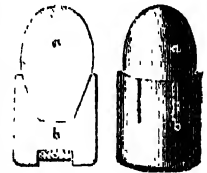
With special projectiles for sporting rifles the most extraordinary results have been achieved by "express" bullets, which are cast with a hollow core extending almost their entire length. Their lightness limits their



"Express" Rifle Bullets.

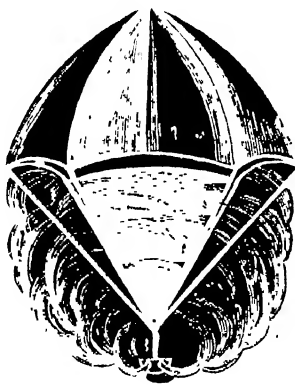
range to about 250 yards, but they are projected by very large charges of powder, and their trajectory is remarkably flat, practically point blank for half their range. They make an enormous wound in proportion to their size, for on penetrating an animal the bullet flattens out into a disc. A similar result to this was achieved by Lord Kean, who slit the points of his bullets longitudinally.

The resistance which a projectile meets with from the atmosphere depends on its entire shape, and not on that of its head alone. A projectile with a cylindrical body and a flat base has to travel with the serious drag upon it caused by the vacuum in rear. Projectiles, like ships, should taper to the rear as well as to the front and although this was well known in the time of Newton, it is strange that the now obsolete Prussian needle-gun is the only serious attempt yet made by a government to take advantage of this knowledge. In the section given, *a* is the projectile, and *b* the sabot to make the base fill the bore. Perhaps the extraordinary results recently achieved by Colonel Hope's gun, the projectile of which tapers very much at both ends, will again draw to this detail the attention it deserves.



Needle-gun Projectile.

The range to which projectiles can be thrown has already increased beyond what we have any use for; the 100-ton gun can throw its 2005-lb. projectile far out of sight; but what is the use of this when it cannot be known whether it is falling near the object or not? The object in increasing the power of guns is not to increase the range, but to deliver a more crushing blow to an ironclad vessel, to penetrate its armour and blow up the magazine, or disable the engines or guns. Six miles is no wonderful range at present; indeed, the range is less limited by the power of a heavy gun than by the danger of elevating the muzzle beyond a certain degree, because this causes the gun to recoil *downwards* with terrific force and crush its carriage as a steam hammer would, or drive it through the deck on which it rests. The power of a gun is not expressed by its range, but by the velocity and penetrative power of its projectile: the shot leaves the muzzle of Longridge's 9.2 inch wire gun at the rate of 2520 feet per second, and at 1000 yards it will pass through 23 inches of iron. Ten years ago these results were looked upon as unattainable,



Boxer's Parachute Light.

up in the following manner:—In an outer sheet of paper, provided with a fuze-hole, are inclosed two hemispheres of sheet tin; one of these is filled with a composition which burns with a brilliant white lustre: the other tin hemisphere incloses a very ample calico parachute, of which the strings are attached by a small chain to the lid of the hemisphere containing the source of light. Sufficient space is left

yet such are the present prospects of artillery science that there is little doubt that these results will soon be eclipsed.

Shells are usually exploded by means of fuzes, which may be classed as—(1) *time fuzes*, when they are intended to explode the shell after a given interval, usually during flight; (2) *percussion fuzes*, when they explode the shell on its striking the object.

● (1.) *Time fuzes* may roughly be classed as of two kinds, wood and metal. Boxer's wood time fuze (Plate II., fig. 3) is a long wooden tube, in the centre of which there is a column of composition which is ignited at the top either by the flash of the powder, or by a small detonating arrangement which acts on the shock of discharge; parallel with the central column is a side column of powder, and opposite it are cross side holes. The fuze is prepared for action by boring a hole through one of the side holes across the powder column into the central column; this hole is bored higher or lower according as the fuze is meant to act sooner or later. On ignition the central column burns down slowly at a given rate, and when the fire reaches the newly-bored hole it flashes out to the side column of powder, which immediately explodes downwards into the shell. In the metal fuzes (figs. 4 and 5, Plate II.) the column of composition is replaced by a horizontal circular ring of composition, contained in a circular metal disc, A A. The time which this ring burns before it explodes the fuze is varied by turning the disc round and clamping it, and is indicated by figures engraved on the outer surface of the disc.

(2.) *Percussion fuzes* (figs. 1 and 2, Plate II.) are usually composed of a hammer or weight, A, a needle, N, and detonating composition, C, so arranged that the shock of impact will cause the needle to penetrate and explode the composition. In the German fuze the needle is placed in the hammer, which flies forward on the sudden stoppage of the projectile. In the British fuze their positions are reversed, the needle being stationary and the composition being placed on the head of the weight.

PROKLOS (Lat. *Proclus*), the last of the Alexandrian philosophers who were in any way memorable, was born at Constantinople in 412, and died at Athens in 485. He studied philosophy, particularly that of Plato and Plotinus, first at Alexandria, and afterwards at Athens. The Neo-Platonic philosophy had establishments at other places besides Alexandria, although this had been its cradle. Proklos was its principal representative and expositor at Athens. Proklos was a voluminous writer. His philosophical and mathematical commentaries on Euclid's "Elements," and his "Elements of Theology," have been translated by Thomas Taylor. He wrote a long commentary on the "Timæus" and other dialogues of Plato. M. Cousin edited (in 1820-27) several of his treatises, which till then had existed only in manuscript, prefixing to them suitable explanatory introductions; but there is no complete edition of the author as yet. The aim of Proklos was to expound Plato in the light of the Orphic mysteries, which he regarded as divine revelations. He was a thorough mystic and a seer, a seer of visions and a worker of miracles, by the testimony of his contemporaries, who held him in the deepest respect. Proklos aimed at reconciling all the ancient religions among themselves and with science; but he entirely refused to deal with Christianity.

PROKNE (Lat. *Progne*), in the Greek mythology, another name of Prokris, the hapless wife of Kephalos. Also the name of a daughter of Pandion, king of Athens, who married Tereus, son of the god Arès, and king of the Thracians in Phokis. Tereus fell in love with Prokne's sister, Philomela, and all three were involved in a tragic tale of the kind dear to Greek legendary lore. See **PHILOMELA**.

PROKOPIOS (Lat. *Procopius*) was born at Casarea in Palestine, about the end of the fifth or beginning of the

sixth century. After studying rhetoric in his native country, he went to Constantinople. He accompanied Belisarius in his chief wars from 527 to 540. On his return to Constantinople the Emperor Justinian made him a senator. He died at an advanced age about 565.

Prokópios wrote in Greek the "History of his Own Times," in eight books. The work is useful, because it forms a link between the history of Ammianus and the other Byzantine historians. His narrative begins with the death of Arkadios, and is continued to the twenty-third year of Justinian, 550. Other works are on the Persian War, on the Vandal War, on the Gothic War (the latter full of interesting details about the habits and customs of the barbarians), and on the public works erected by Justinian. But the most remarkable work of Prokópios is his celebrated "Anekdota," or secret history of his times. Here Justinian and Theodóra are painted in glaring colours, and the adulation of the courtly historian, so fulsomely preserved in the work meant for the public eye, changes in this work, jealously guarded by the author and his friends, into a complete *chronique scandaleuse* of the time, valuable even in its triviality. It is scarcely necessary to say that the "Anekdota" was not published nor even known of in the lifetime of its author, and on this ground its authenticity has been frequently challenged; but at every attack the evidence in its favour, both internal and external, only grows the more cogent. (Complete works, Dindorf, Bonn, 1833-38.)

PROKRIS (Lat. *Procris*), the daughter of Erechtheus II., king of Athens, grandson of him who was commemorated by the Erechtheum. She married Kephalos (Lat. *Cephalus*), and was killed by him accidentally. The story is a favourite one with the poets. See **CEPHALUS**.

PROKROUSTES (Lat. *Procrustes*), literally "the Stretcher," was the sobriquet of Demastès, a robber famed in the Greek mythology. He guarded a narrow way in Attica near Eleusis, robbing all who passed by, and was, moreover, "a fellow of infinite jest" for he had a bed whereon he laid his victims, and if they were of just that length he let them go with their lives, but if not, he killed them, dragging out their limbs by force to the full length of the bed if they were too short, or cutting off their feet if they were too tall. Theseus delivered the world of this monster.

PROLAP'SUS ANI (or the falling down of the bowel) consists of an inversion of the lower part of the rectum, the protrusion presenting usually the form of a red rounded swelling overlapping the anus. In severe cases the length of bowel protruded may be several inches. It is generally observed between the ages of two and four, but it occurs also later in life. In the case of children it usually arises from an impaired state of health, which occasions a relaxed condition of the bowel; from irritation such as that produced by worms or prolonged diarrhoea; or from constipation, which causes excessive straining during a motion. The treatment consists in careful attention to the general health, with the removal of any cause of irritation, and in the careful return of the part by a little steady pressure after every motion, an operation greatly facilitated by the use of a little simple ointment or oil. Astringent injections are sometimes employed with advantage to relieve the relaxed state of the membrane, and where the bowel slips down when the child moves about, it may be retained in its place by a conical pad and bandage. Great care must be taken during treatment to avoid constipation, and sometimes it is necessary to cause the patient to relieve the bowels in a recumbent position. Where the exposed surface is ulcerated it may be painted with a solution of nitrate of silver, 20 grains to the ounce. Young subjects usually outgrow the complaint, and in the majority of cases its appearance in a child need cause no alarm, for though it may be an indication of impaired health, it is not

in itself dangerous. Where the complaint appears in adults its treatment may necessitate the use of the mineral acids for the contraction of the aperture and the retention of the rectum, while very severe cases can only be dealt with by surgical operation.

PROLATE SPHEROID. See OBLATE.

PROLETA'RIATE (Lat. *proletarius*), a name now commonly applied to the poorest classes of the population by French political economists, from whom it has been borrowed by English and German writers. It is derived from the Latin *proletarii*, the term applied in the constitution of Servius Tullius to those citizens who were absolutely without any other property to contribute to the service of the state than their *proles* or offspring.

PRO'LOGUE (Gr. *prologos*, from *pro*, before, and *logos*, speech) is usually applied in English to the short poem of verses which are sometimes prefixed to new plays, to recommend them to the favour of the reader or spectators. The fashion is dying out, but in the Georgian era it was still in full force, and the prologues of Pope, Johnson, Goldsmith, and Garrick are little *tour de force* still well worth study. In the comedies of Plautus and Terence we find prologues of this kind. According to Aristotle the name of prologue was applied to that part of the Greek tragedy which preceded the *parodos*, or first speech of the chorus.

PROME, the chief town and headquarters of Promé District, in the Pegu Division of British Burma, is situated on the left bank of the Irawadi. The town extends northwards from the foot of the Promé Hills to the bank of the Na-weng, with a suburb on the further side of that stream; and eastwards for some distance up the Na-weng valley. It is divided into several municipal quarters. Skirting the high river bank are the police office, the government school, the court-houses, the church, and the telegraph station. The Strand Road traverses the town from north to south, and from it numerous well-laid roads run eastwards. The great Shwe-tshan-daw Pagoda, conspicuous among the dark foliage of the trees covering the slopes of the hill on which it stands, is near Promé. The railway station lies a little south of the court-houses. The town was almost entirely destroyed by fire in 1862.

Promé is mentioned in ancient histories as the capital of a great kingdom before the Christian era, but the town spoken of was Tha-re-khetra, some miles inland, of which traces still exist. After the destruction of Tha-re-khetra, about the end of the first century, Promé for many years belonged sometimes to Ava, sometimes to Pegu, and sometimes was independent. But after the conquest of Pegu by Aloung-bhura, it remained a Burmese town until Pegu was annexed by the British in 1853. The population is 32,000.

PROMETHEUS, in ancient mythology, a son of the Titan Iapetus and of the nymph Klymené, a daughter of Okeanos, represents symbolized "forethought" or sagacity, as Epimétheus, his brother, was the type of "after-thought." Atlas was another brother of Prometheus. The myths respecting Prometheus are very numerous, and cannot be satisfactorily harmonized. We shall adopt that which is at once the most consistent and the most poetical:—Prométheus, looking around him, was smitten with compassion for the woes of men, who were neither able to cook food nor to build houses. Though an immortal god, he sympathized with humanity, and was capable of any sacrifice for its advantage. He had assisted Zeus, the supreme power, in his wars with the Titans, but now that he saw him determined to refuse the knowledge of fire to mankind, he did not hesitate to oppose him, and having stolen the celestial fire, imparted the gift to mortals, and afterwards instructed them in those arts which render life endurable. He invented architecture, astronomy, the use of letters, medicine, navigation, working in metal, and

the mystery of prophecy. In a word, he was the embodiment of human knowledge striving with adamantine necessity. Zeus now resolved to punish his daring foe, and despatched Hermés to chain him to the rocks of Caucasus, where an eagle perpetually gnawed his liver—typical of man's restless longing after something unattainable. The wrath of Zeus, meanwhile, flamed furiously against mankind, because of their untamable champion. Prométheus had advised his brother Epimétheus to accept no gift proffered by the gods, but Zeus commanded Héphestos to fashion a virgin, who from each of the deities should receive a special endowment. Pandora was so created, and, clothed with irresistible charm, was presented by Athéna to Epimétheus, who unwisely received her into his house. He had to guard a casket containing all the ills that could afflict humanity. Here, as in Scripture, the woes of man are made to spring from the disobedience and curiosity of woman, for Pandora raised the cover of the fatal casket, and out sprang a dire succession of evils—war, and plague, and famine, and greed, and hate, and disease; while, in her terror, she unhappily replaced the lid before hope, which might have alleviated these calamities, could escape. (For a different version of this part of the legend see PANDORA.)

Prométheus, chained on his lonely rock, tortured, but unyielding, was visited by Hermés, in a vain endeavour to obtain his great secret—who was to be the son and successor of Zeus. The benefactor of men refused to communicate his knowledge, and Zeus, in revenge, hurled at him his lightnings, and dashed him into Tartaros to undergo fresh tortures. Cheirôn, the centaur, at length offered himself as a substitute for Prométheus in Hádés, for Cheirôn, fatally wounded by Héraklés, existed in perpetual torture. His offer was accepted by Zeus. Héraklés killed the torturing eagle, and Prométheus was released. Hereupon he revealed that if Zeus were to have a son by the goddess Thetis, that son would supplant and destroy him. Zeus of course took care that this should never occur.

This, with slight variations, is the story told by Aischulos in his immortal tragedy. Another legend represents Prométheus as punished for his unlawful love of Athéne, the virgin child of Zeus. A third makes him the father of Deukalion, whom he warns to build the ark which saves the remnant of mankind from the great flood. Again, he appears as creating man out of clay, into which the winds breathe life. And, finally, the feud between him and Zeus is said to have originated in the institution of sacrifice. Prométheus, cautioning men that their substance would be wasted if they consumed the victims with fire, slew an ox, and dividing the body into two parts concealed the meat and intestines under the skin and paunch, and the bones under the fat. Zeus being requested to lay his hand on the portion he preferred for himself, took the fat. Great was his wrath when he found that henceforth his share was to be the bones, while the flesh would belong to men. He revenged himself by depriving mortals of the gift of fire, which they had previously enjoyed.

The explanations which have been attempted of this myth are as numerous as the versions of it. Suffice it to say that, in its later form, it is curiously like the Hebrew prophecies of a Redeemer, who, himself immortal and divine, should voluntarily undergo a series of tortures and sufferings for the benefit of man. Strong in the knowledge of its own might, the Soul, the creative intellect, does not fear to brave the will of Zeus, and if it cannot conquer Fate, baffles its aims by a sublime endurance. Such is the moral of Shelley's lyrical drama of "Prométheus Unbound," where, however, the champion does not, as in the old myth, become reconciled with the oppressor:—

"To suffer woes which Hope thinks infinite;
To forgive wrongs darker than death or night;
To defy power, which seems omnipotent;

To love and bear; to hope till Hope creates
From its own wreck the thing it contemplates;
Neither to change, nor falter, nor repent;
This, like thy glory, Titan, is to be
Good, great and Joyous, beautiful and free;
This is alone Life, Joy, Empire, and Victory!"

PROMISSORY NOTE, a written contract by which one or more persons agree to pay to the promisee a certain sum of money at a specified date. When drawn on a proper stamp it is legally negotiable in just the same manner, and under the same conditions, as a bill. No negotiable or transferable bill or note (not being a draft on a banker) can be lawfully drawn or made for any sum under twenty shillings. A promissory note requires indorsement before it is negotiable. The form usually adopted is "(Three) months after date I promise to pay (John Brown) or order the sum of for value received. Alfred Smith." The words italicized used to be thought indispensable, but recent decisions have shown them to be worthless. Another form begins "On demand," and is of course payable at any time the note may be presented. If, however, instead of the words "On demand I promise to pay (John Brown) or order," &c., the words "On demand I promise to pay to bearer," &c., were used, the document would become illegal, this being essentially the form of a bank-note, and limited to the use of the Bank of England and other specially qualified banks.

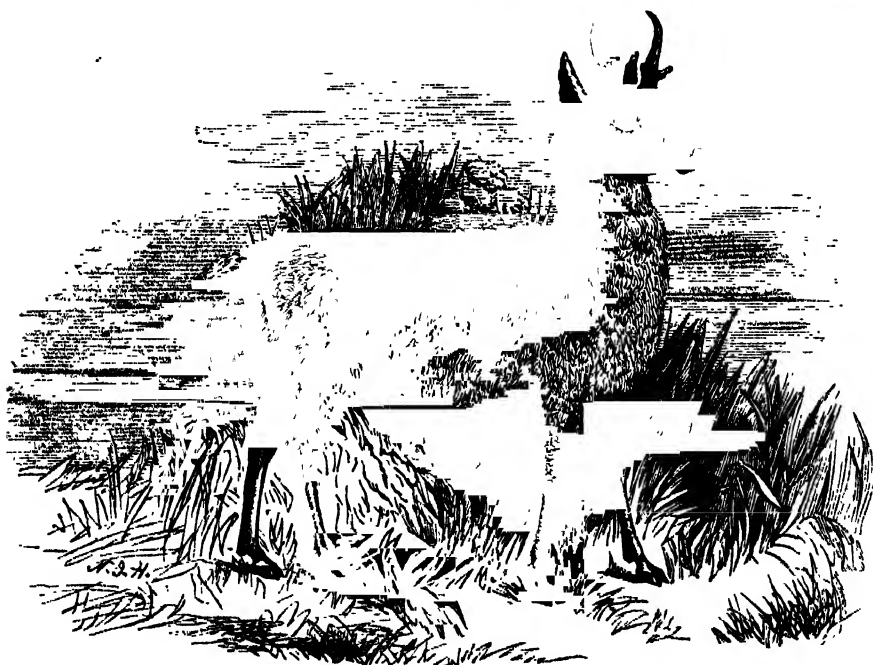
PROMONTORY (Lat. *promontorium*; from *mons*, a mountain), in geography, a high or low point of land projecting out into the sea, the extremity of which is termed a headland.

PROMPT, a commercial term derived from the Latin *promptus*, something expressed or set forth; and as things set forth are in readiness and can be quickly handled, the

word came in Latin to mean quick or ready. Prompt has both meanings in English; and a punctual payment is called a prompt payment, or a quick man of business is said to be prompt. The special business term has the original Latin meaning, however, and in this sense prompt becomes a noun, signifying an expressed agreement as to price and payment, especially among shippers, merchants, &c., so that we speak of a three months' prompt, or of a six months' prompt, meaning an agreement to pay a stipulated price, at a specified deferred date, for certain goods which are then to be delivered. If, however, the merchant desires to have his goods earlier than the prompt date he must pay for them on delivery. But, on the other hand, he must pay at the prompt date whether the goods are delivered or not. *Promptus* came originally (in Latin) from *pro-emere*, to purchase in advance, and lost (in Latin) this meaning in favour of the one given above; but it has come in the "revenge of time" to have again its original Latin meaning, and to denote a buying forward.

PRONA'OS, in ancient architecture, the front porch of a temple. The portion behind it, inclosed within walls, was called the *naos*, whence the *nave* of our Christian churches.

PRONG'HORN (*Antilocapra americana*) is a remarkable species of ANTELOPE inhabiting Western North America, made by some the type of a distinct family, Antilocapridæ. In the character of its horns it differs from all other antelopes. These organs are about a foot in length, arise from the forehead immediately above the eyes, and give off from about the centre a short branch directed forwards; they are flattened from side to side, and curved backwards at the tip, which is sharp-pointed. Unlike any other antelope the pronghorn sheds its horns every year,



Pronghorn (*Antilocapra americana*).

these organs becoming detached from their supporting cores and being replaced by a fresh growth. Rudimentary horns are also present in the females. The pronghorn stands about 8 feet high at the shoulder. It is graceful in figure, with the body stoutly built, a short tail, and long

limbs. The small pair of accessory hoofs often present in antelopes are entirely absent; cutaneous glands producing an odiferous secretion are present. The ears are erect and pointed, and the eye is very large. The body is thickly covered with a close-set fur, the hairs of which lengthen

in winter and become very stiff and brittle. In colour it is a pale fawn generally, becoming whitish on the under parts; the tail and the rump are pure white.

The pronghorn is numerous on the southern branch of the Saskatchewan and the upper plains of the Columbia River. It is gregarious, associating in troops which frequent the open country, never resorting to wooded districts. They migrate from north to south according to the season, and are swift and timid, but at the same time curious and inquisitive, wheeling round in circles to scan the object of alarm, and thus often come within the gun of the hunter and fall a sacrifice to the artifice of the wolf. The flesh has a peculiar odour, which renders it unpalatable to some people.

PRONOUNS are usually described as words used as substitutes for the names of persons and things. But this definition is scarcely wide enough. Only one thing can be called *sum*, only a few things *white*, but any and everything can be called I, you, it, &c., given the proper relationship. The Hindu name is *Savarnāman*, "the universal or unlimited name," and is better than ours. Pronouns are commonly divided into personal, demonstrative, interrogative, relative, and indefinite; but it appears probable that, with the exception of the first and second personal pronouns, the first four classes were originally demonstrative. William Humboldt remarks that the first and second personal pronouns "are not mere substitutes for the names of the persons for whom they stand, but involve the personality of the speaker and of the person spoken to, and the relation between them;" and in writing and conversation there is frequently hardly any name which can so clearly designate the person intended as the appropriate personal pronoun.

Investigating English pronouns more closely, they are found to be of curiously diversified origin and history. Some of the main features only may here be set down.

1. *Personal Pronouns*.—The substantive pronouns have no gender, and only two persons, the first person being he who speaks, and the second he who is spoken to. In the first personal pronoun (I, me; we, us) I stands for *ah-am* in the Sanskrit, *ego* in Greek and Latin. In English, as in these latter, the *m* appears only in the other cases, not in the nominative; and in modern English the guttural is absent, the old form being *ie* or *ich*. (See also the modern German *ich*.) *Me* as a dative is still used in *methinks*, but formerly had a much greater use, as see the comic scene between Petruccio and Grumio ("Taming of the Shrew," i. 2), "Villain, I say, knock me here soundly!" &c. This dative *me* had originally an *r*, as in German *nir*. The accusative *me* was in Old English *mec* (Ger. *mich*). *We* is for the Sanskrit *rayam*, and when closely studied is seen to be a compound of I and a demonstrative, as it were *I-that*. *I's* has lost an *n* (Ger. *uns*, Old Gothic *unsie*); and the dative *us* = Sanskrit *a-sma-bhyam*, while the accusative *us* is the worn-down remains of the very different word *a-smā-n*.

The second personal pronoun (thou, thee; you or ye, you) is similarly worn. *Thou* (Gr. *su*, Lat. *tu*) represents the Sanskrit *tvam*, the *m* altogether gone. In Shakspeare's time it was the address of affection, also of superiority, and hence also of contempt; it has now become so archaic that it has been adopted as the special language of prayer, and occasionally of poetry. *Thee*, dative, represents Greek *soi*, Latin *tibi*, Sanskrit *tubhyam*; accusative represents the quite distinct Greek *se*, Latin *te*, Sanskrit *tvām*. It is almost like looking at a few ruined pillars which mark the place of a temple. (The Society of Friends used, till lately, frequently to employ *thee* as a nominative, as "I hope thee art well, friend," &c.) *Ye* is the Greek *hu-meis*, the Latin *vo-s*, the Sanskrit *yusmē*. The latter is seen at once to be made of *tu* and *ama*, that is *thou-he*. This is the proper nominative plural of the second personal pronoun,

and indeed *ye* is accurately so used in the Bible, *you* being always dative or accusative; but the exigencies of poetry drove the Elizabethan dramatists to hopelessly mix up the two, no one being a greater sinner than Shakspeare. *You*, dative, stands for the ruin of the Greek *hu-min*, Latin *vo-bis*, Sanskrit *yu-sma-bhyam*; accusative, for Greek *hu-mas*, Latin *vo-s*, Sanskrit *yu-smān*; having passed through the Old English form *eow*, the case-ending, besides, having wholly disappeared.

The third personal pronoun is a demonstrative, and in fact has not a strict right to be called a personal pronoun at all. It has the distinction of gender, as all demonstrative (but no personal) pronouns used to have in Old English. It now has the forms *he*, *him*; *she*, *her*; *it*; *they*, *them*; and these are from three roots, *hi*, *sa*, and *tha*; but in Old English the entire pronoun was formed on the root *hi*.

	Masc.		Fem.		Neut.
Nom., . .	<i>he</i> ...		<i>heo</i> ...		<i>hit</i>
Gen., . .	<i>his</i> ...		<i>hire</i> ...		<i>his</i>
Dat., . .	<i>him</i> ...		<i>hire</i> ...		<i>him</i>
Acc., . .	<i>hine</i> ...		<i>hi</i> ...		<i>hit</i>

So also with the plural. For *he* we often find *ha* or *a* in the older English, as the familiar "quoth a" in Shakspeare; and this of all genders. *Hi-m* is peculiar in retaining its true dative suffix, *m*, but is not now used, except by children and rustics as a dative neuter. *Him*, the dative form, began to replace the true accusative, *hine*, about the twelfth century, the latter still existing in many various dialects—"Hit *en* again," "Go at *un*, boy," &c. *She* (really the feminine of the definite article in Old English) replaced *heo* at the same time, but *ho* or *hou* is still the feminine of the poorer Lancashire folk, "Hoo's wolly clemmed" (she's almost starving). *Her* is remarkable for its feminine dative suffix *r*; and here again the dative form drove out the true feminine accusative, *hi* (or *heo*). It had originally a guttural initial, indicated by *h-it*, also disappearing in the twelfth century. The *t* of *it* is the *d* of Latin *illu-d*, *qui-d*, &c., and the same may be said of *thu-t* and *wha-t*. *It*, as a dative, has replaced the true dative *him*. *They* came into use as late as the thirteenth century, and then only in the north of England at first; it is really a modification of the nominative plural of the definite article *tha* (the); and *them* is the dative plural of the same. Here again we have a dative (*thim*), taking on the accusative meaning as well as its own, and replacing *hi* and *heo*, the Old English accusatives plural, as well as *herm* and *hem*, the datives plural. The latter remain in common speech, as *em* (usually written *'em*, but representing *heom*, not *them*), as in the phrase "Give it 'em."

Reflexives are made of these pronouns with or without the word *self*, as "I hurt *myself*," "He repented *him* of the evil." *Self* originally meant "same," as "in that self moment" (Chaucer), "that self mould" (Shakspeare, Richard II. i. 2); but the expressions *myself*, *thyself*, &c., seemed on the surface to mean "my or thy personality," and so *self* came to be considered a noun, and to have a plural *selves*, as "thy crying self," "to our gross selves," both examples being from Shakspeare. The words *himself*, *itself* (not *its self*), still show the Old English construction, which was to use the dative of the pronoun; and "Tarquin's self" (Shakspeare), which is evidently meant for a genitive, is consequently etymologically wrong. *Themselves* is a barbarism, arising from the confusion of *self* as a noun, mentioned above.

Possessive pronouns were originally made of the genitive cases of personal pronouns; and although they are now indeclinable, were formerly declined as adjectives down to the fourteenth century. *Mine*, *thine*, show a genitive *n*, the *e* being simply added to make the *i* long; and this *n* dropped off before a consonant in the twelfth century,

leaving *my, thy*, as the substituted forms. The originals were later on driven out by their substitutes, and are now only found in poetry; but the usage just referred to is very clearly shown in Shakspeare's line,

"Give every man thine ear, but few thy voice."

His is a true genitive of the root *hi*; and *her* contains a true genitive suffix *r* for *re*. *Its*, however, is quite a corruption. It did not drive out the correct form *his* till quite the end of the sixteenth century. It is not found at all in the Bible (except when put in by the reprinters), and only very rarely in Shakspeare and Bacon; even Milton often uses *his*, not *its*. The general Bible usage is well-known ("I shall bruise thy head and thou shalt bruise *his* heel"); but another tentative use of an uninflected *it*, to get rid of the apparently masculine form *his*, is less familiar. A good example is seen in Lev. xxv. 5—"That which groweth of *it* own accord," unfortunately altered to *its* in the modern reprint. So also "King Lear," i. 4,

"The hedge-sparrow fed the cuckoo so long
That it's had it head bit off by it young."

Our and *your* have a true genitive suffix *r*, as has also *their*, which has replaced the original *hi-re*.

Absolute possessives is a name often given to the pronouns mine, thine, his, its, hers, ours, yours, theirs; because they may be used without a following substantive, as "this is mine," &c. Of these the last four have a double genitive suffix, namely, the plural *r*, and also the singular *s*; the latter addition (of *s*) was for a long time unknown in the south after the north was using the two (*-rs*). In provincial English instead of the second suffix *s*, which is a singular form, a plural form *en* is used; and we get *hern, ourn, theirn*.

2. *Demonstrative Pronouns*.—These are used both substantively and adjectively, with the exceptions of *the* and *yon*. They are—*this*; *that*; *those*; *this*; *these*; *such*; *thilk*, *ilk*; *same*; *yone*, *yond*, *yonder*; *so*. *The* was formerly fully declined, but has been indeclinable since the twelfth century. It is, or was, often called the definite article, and is therefore fully described under ARTICLE. *Ilk* = he-like, and *thilk* = the-like, are the Lat. *ta-lis* and the original demonstratives. (*Thilk* is provincially "thickey," but is another form of the same word.) These words were in the fourteenth century driven out by a new neuter form *tha-t*, which speedily became applied to all genders and took to itself *those* for a plural, *those* being really the original plural of *this*. The word *this* is the Lat. *hic*, and in its early form was *thes*, *mas.*, *theos*, *fem.*, *this*, *neut.*; the neuter form gradually, about the middle of the fourteenth century, driving out both the masculine and the feminine. *Such* stands for the Old English *swiðe* = so-like. *You*, *yond* is the Gothic word for "that," *jains*, *mas.*, *jaina*, *fem.*, *jainata*, *neut.* *So* is the Old English *swa*; "make friends, and keep them so."

3. *Interrogative Pronouns*.—These are—who, which, what, whether, and their compounds. *Who* is the Old English *hwæ*, the Gr. *pos*, Lat. *quis*, Sanskrit *kás*, and is now indeclinable and limited to men and women, though formerly, of course, of all genders; *whose* is the Old English genitive of *hwa*, namely, *hwæs*; and *whom* the old dative *hwam*, as well as the old accusative *hwome* (see remarks on *me*, *ther*, &c.) *Wha-t*, as the *t* shows, was the neuter of *who*; it is now singular and neuter without a noun, but of both numbers and all genders with a noun. *Whether*, the Old English *hwæther*, meaning "which of the two," has slipped out of general use since the beginning of the eighteenth century. "Whether is greater the gift or the altar that sanctifieth the gift?" (Matt. xxiii. 19.) *Which* is for *whilk* (that is, *hwa-lic*, who-like), just as *such* stands for *swiðe*. It exactly represents the Lat. *qua-lis*.

4. *Relative Pronouns*.—These are—who, which, that,

what, as. *Who* and *which* were originally not relative but interrogative pronouns, and remained so down to the sixteenth century. *That* and *what*, as the neuter *t* indicated, were at first confined to neuter antecedents; and *which*, once not so confined (as "Our father which art in heaven"), has now taken on that limitation. The demonstrative is sometimes omitted, as in "Who steals my purse steals trash" ("Othello," iii. 3); also the relative, as in "we speak that we do know" (for "that which"). *That* came in during the twelfth century to supply the place of the indeclinable relative *the*; in the sixteenth century *which* took its place; in the seventeenth century *who* succeeded; but in the eighteenth century *that* came into favour again. It is very whimsical, therefore, to find Addison, who was no antiquarian, complaining in his "Humble Petition of Who and Which" that "we are descended of ancient families and kept up our dignity and honour many years, till the Jack Sprat that supplanted us;" for *that* was the rightful owner, and *who* and *which* the usurpers. *As* is the old English *eall-swa* = all-so (compare the Ger. *als*), and takes its relative force from its being a compound of *so*; its use is well known, as in "Julius Caesar," i. 2, "That gentleness as I was wont to have." *Whoso*, *whosoever*, &c., are relatives closely resembling the Lat. *quisque*, *quiscunque*, &c. *Whoever*, *whatewer*, and *whichever* are comparatively late forms, and are not found in Old English.

5. *Indefinite Pronouns*.—These are used, some substantively, some adjectively, and most indeed may be used both ways. They do not specify any particular object. The chief are the following:—*Who*, when it means "some one," as in Gower, "She was, as who saith, a goddess;" *what*, as in "I tell you what," "I know not what," &c. *Some* is the Old English *sum*, and is used as by Wyclif (Luke i. 5), "There was sum prest," or by Dickens, "Built by some Dutch merchant long ago," also in the expressions "Some years ago," "Some 20 yards long," "The work some praise, and some the architect" ("Paradise Lost," i. 781), "Some device or other" ("Comedy of Errors," i. 1); and the compounds, somebody, something, someone, somewhat, &c. *All* and *some* = one and all, has become obsolete, but was once very common (see Dryden, "Absalom and Achitophel"): "Stop your noses, readers, all and some." *One* is merely an extension of the numeral to pronominal uses, with the genitive *one's* and the plural *ones*: "Here one may change one's old lamps for new ones." Or it equals "the same," as "It's all one to me." Or it equals "some one," as "Here cometh one, I will withdraw" (Lily). *Man* is very similar; "As though a man should say," exactly replaces "As though one should say." *None* and *no* (the latter formed from the former by the *n* dropping away) are simply the negatives of *one*, the pronoun. *Aught* is the Old English *a-wiht*, that is, any-whit, anything; "For aught I know" is a familiar use of it; *naught* is its corresponding negative. *Enough* and *enow* are the Old English *genoh*; compare the German *genug*. *Any*, the Old English *anig*, is formed from the numeral *one*, and has many pronominal derivatives, as anyone, anybody, anything, &c. *Each* is the Old English *ealc*; that is, any-like, and is properly singular, but has acquired a distributive sense, as "Of the fruit of each tree in the garden we may eat" ("Paradise Lost," ix. 661); its compounds are *each one*, *each other*. *Every* = "ever each," and is the Old English *æwer-ealc*, unknown till about 1200; *everybody*, *everyone*, *everything* are derivatives of rather late origin. The older writers use the simple word, as "Every of your wishes" ("Antony and Cleopatra," ii. 2). *Either* is the Old English *æg-hwæther*; it has a possessive form, *either's*, and a negative, *neither*, *neither's*. *Other* is the Latin *alter*, Gothic *anþar*, and originally means "second," one left out of two, but it has now a plural, *others*, as well as a possessive, *other's*; and derivatives—another, some other, one another, each other. *Else* is the Old English *elles*, the

genitive of the demonstrative root *ele*, comparable to Latin *al-lus*. It is chiefly used with aught and naught, as "Naught else but pain." *Sundry* (Old English *sunderig*, meaning "separate") is now always used in the plural, as "To all and sundry, greeting," but was formerly not so limited, as in "As You Like It," iv. 1, "The sundry contemplation of my travels is a most humorous sadness," where the word means separate, solitary. *Several* is almost equivalent to *sundry* in this latter sense, as in "Julius Cæsar," iii. 2, "To every several man 75 drachmas;" and as in Ben Jonson's fine line, "Truth lies open to all; it's no man's several." *Divers* and *different* are used in a similar sense. *Certain* is now used only adjectively, "A certain man planted a vineyard" (Mark xii. 1), but it was used as a substantive by our older writers, as Chaucer—

"Beseeching him to lend him a certain
Of gold, and he would quit it him again."

PRONUNCIATION. It is impossible within the limits of the present work, to treat so large and excessively diffuse a subject as that of pronunciation. The reasons why certain nations always choose certain letters in preference to others closely akin to them, the reasons underlying GRIMM'S LAW in fact, are at present quite obscure, to speak broadly, and though we know the fact we have not even a tolerable working hypothesis to explain it. But, setting this vast and almost unexplored problem on one side, there remain the local and the historical variations of pronunciation in all languages, which are exceedingly large and numerous, absorbingly interesting, but very difficult to summarize. All that can here be attempted is an indication of some of the main developments in the pronunciation of our own tongue.

We might hope to get some help from orthography, but this is seen by any student to be quite fallacious in the first few minutes he spends upon the subject. The fact is, that orthography follows pronunciation at a very great interval, and that this interval grows greater as we advance. Printing and the accumulation of classic authors have set up a common standard, and we all say *wimmin*, and write *women*, or say *clark*, and write *clerk*, with scarcely a perception that we are at variance with ourselves. Curiously enough, in the last instance a very great tendency to say *clerk* (clurk) may be noticed among all but the higher classes, and represents a praiseworthy effort to systematize the language. Since the mountain will not come to Mahomet, Mahomet must to the mountain, and as spelling is so stubborn, it proves easier to change pronunciation.

One of our early great writers, Orm, in his versified narrative of the Gospels, called, after his name, the "Ormulun," and written A.D. 1215, made a very earnest and determined attempt to represent pronunciation by orthography. One of his devices was always to double a consonant after a short vowel; and he formally enjoins transcribers of his book to observe this rule, and "an bocstaf writ twiggess," i.e. write a letter (*bookstaf*, the German *buckstable*) twice, wherever the poet has done so.

"For he ne magg nehht elles
On Ennglish writenn riht to word
Thatt wite he well to sothe."

(For else he may not write rightly the word in English, that know he well for certain.) Chaucer too writes a prologue to one of his books—"Go, little book," he says, and presently, "So pray I to God that none miswrite thee," &c. Nevertheless, till printing became general, orthography varied with the talk of the writer. Shakespeare and the Bible fixed our spelling for us; but even then Raleigh's name has been shown to be spelt three ways on one page (Ralegh, Raleigh, Wrawlegh), and this, occurring with a man so cultured and so famous, shows what great latitude was taken. Another familiar example is Shakespeare, whose name varies from Shaxper onwards in admired confusion.

Two great changes have occurred in English pronunciation (excluding the variations of local dialect): the first due to the Normanizing or Frenchifying of the Old English speech; the second to the Latinizing of the Anglo-Norman (or Middle English) speech. The great test of these things is *rhymed poetry*, and very remarkable changes are made evident by rhymelessness having supplanted a once excellent rhyme.

The great changes from Old English to Norman English were the changes of the old initial *c*, which had the force of *k*. Of words beginning with *c* a good many took a *b* (or a hard *c*) as *Cent*, *Kent*; *ceol*, *keel*, &c.; but a very large proportion changed the *c* to a *ch*, as *circe*, *church*; *cild*, *child*, &c. So careful did men become to make this soft *ch* clear that in the middle ages many such words were spelt with *tch*, as *ritch* (Spenser). The *ch* sound once introduced quickly extended, and *chaste* stood for the Latin *castus*, *charity* for the Latin *caritas*, *chant* for the Latin *cantus*, &c. But such survivals as the Scottish *kirk* still here and there preserve the original speech. A similar change softened the Old English *g* into *dg*, as *hedge* for the original *hege*, &c., and the *sc* (pronounced *sk*) into *sh*, as *scild* (for *skild*) turned into *shield*, *sceop* into *sheep*, *sceo* into *shoe*, &c. In a few cases, as *skin*, *school*, *scale*, *scar*, &c., the old pronunciation, though not the old spelling, remains. The guttural *hw*, retained in the Old Scottish *qua*, *quhilk*, &c. (for Old English *hwa*, *hwylc*, &c.), is yet heard, although the modern spelling *who*, *which*, &c., has quite replaced it; but in England the *wh* is either mute (with the vulgar) or sounded as an *h* or *hw* aspirate initial (with the educated), the guttural having quite disappeared. The effort to preserve this guttural *h* is amusingly shown in the vain substitution of *light*, *might*, &c., for *liht*, *miht*, &c.: modern English, already uneasy at the *h*, makes no difficulty of omitting the *g* as well, and pronouncing the words *lite*, *mite*, &c. This *gh*, as an attempt to retain the guttural *h*, has a varied fate indeed. The Old English *burh* becomes borough, and the *ugh* is here mute; *dahter* becomes daughter, and here the *gh* is a *w* (with local variations of *du(r)ter* and *dafter*, &c.); *enoh* becomes enough, where *ugh* is simply *f*, so also *laughte*, &c. In many words (as in the example of *daughter* just given) several of these changes are found at once. For instance—

"Farewell! thou had me taught (toft)
That love hath set aloft."—*Surrey*.

"Despondency, good man, is coming after,
And so is also Much-afraid his daughter" (*dafter*).
—*Bunyan*.

"Better to hunt the fields for health unbought
Than fee the doctor for a nauseous draught."
—*Dryden*.

The Frenchifying of our tongue had reached its height before Chaucer's time, but in his poetry it is remarkably apparent in its main feature, the tendency to accent words on their last syllable. The French do so to this day, but we have since returned to the older English custom of throwing back the accent as far as possible. Chaucer says *contree*' (country), *cora'ge* (courage), *natur'e* (nature), *lang'ys* (language), and so on. Milton retained many of these accents—

"His meek aspect."—"Paradise Lost," vi. 450.

"And of their vain contest' appeared no end."
—"Paradise Lost," ix., last line.

"And with contra'ry blast proclaims most deeds."
—"Samson Agonistes," 872.

Shakespeare not nearly so often, but still sometimes, as in "Romeo and Juliet," i. 5—

"You must contra'ry me, marry 'tis time."

It has come about that we distinguish the verbal and nounal use of words by this means. Chaucer's *concert* is our *con'cert*, but we retain his pronunciation for the verb; so also *rec'ord* and *rec'ord'*, *reb'el* and *rebel*, &c. *Hum'ane* and *human*, *aug'ust* and *august*, *con'jure* and *con'jure*, &c., are examples of the same word distinguished in meaning by using both the Old English and the Norman-English style of accent.

Another Norman-English sound was the *ah* sound of the vowel *e*, clearly shown even so late as in the rhymes of Villon, the famous French poet, *barre to terre*, *Robert to pluspart*, &c. This is found in Chaucer very frequently. *Dertemouth* is our *Dartmouth*, *sermon*, *servant*, &c., are by their rhymes shown to be *sermon*, *servant*. We still say *parson* for *person* (and here we have altered Chaucer's spelling), *sargeant* (sergeant), *clark* (clerk); but *marchant*, as Chaucer would have spoken it, and as the French *marchand* still has it, has retained its Chaucerian spelling, and has compelled pronunciation to follow it. Most people now say (as they spell) *Derby*, *Hertford*, &c., for the older *Darby*, *Hartford*.

All oddities of pronunciation tend to disappear. It is only in our own day that *doom* (dome), *Room* (Rome), *vaws* (vase), *chaney* (china), *ohlege* (oblige), *gould* (gold), *yalow* (yellow), and the like have disappeared; all persons of middle life must have noticed them still occurring in the conversation of elderly and refined people. At this day some of our best (aristocratic) speakers still pointedly drop the final *g* in the present participle, as *comin'*, *appearin'*, and the like.

A curious mediæval adoption of a local pronunciation is seen in the numeral *one*, which, of course, was in Old English *on*, or very near it. (Londoners still say 'un, "A good 'un to go," &c.) In Somerset, Devon, &c., the custom of prefixing *u* to such sounds prevailed, and still prevails, and it is even now not uncommon to hear "the *won* on the *wother*;" *wother* has not gained a footing, but *won* for "one" is quite triumphant. Dorsetshire yet revels in *woaks* (oaks), *woats* (oats—in Yorkshire *wuts*), *wold* (old), &c.

The diphthong *ea* has a chequered history with us. It replaced in many words the vowel *e*, the open Chaucerian pronunciation of which is still preserved in modern Irish-English. As the Celtic Irish had to learn English as a foreign tongue, while still the original *ea* sound existed, they learnt and have ever since practised it; just as the Americans have retained unaltered many peculiarities which time has changed with ourselves. The Irishman's *baste*, *craytur*, &c., are Chaucer's *baste*, *creture*, &c., exactly preserved. When, later on, the tendency was to shorten the *e* (as to *best*, *cretture*, &c.), it was counteracted by the addition of *a*, and the words were spelt *beast*, *creature*, &c., with the express object of retaining the *ay* pronunciation. This was actually thus preserved for many centuries. When, therefore, "the cup that cheers but not inebriates" was introduced, and the French called it *thé* (tay), the English equivalent was *tea* (pronounced *tay*). So Pope—

"Here thou, great Anna, whom three realms obey,
Dost sometimes counsel take, and sometimes tea" (tay).
—"Rope of Lock," iii.

As to the diphthong in general, we may turn to all the great writers for instances.

"The peasant and the post, that serves at all assays;
The shipboy and the galley slave have time to take their ease"
(aise). —Surrey.

The Irishman's "*aisy now, aisy*," is seen to be pure Elizabethan pronunciation.

"If reasons (*raisons*, i.e. raisins, for the pun's sake) were as plenty as blackberries, I would give no man n

reason (*raisin*) upon compulsion, I!" (Shakspeare's "First Henry IV.," ii. 4).

"With stories told of many a feat (*fate*),
How fairy Mab the junks ate."
—Milton's "L'Allegro."

"But tim'rous mortals start and shrink
To cross this narrow sea (*say*),
And linger shiv'ring on the brink,
And fear to launch away."
—Dr. Watts' Hymn.

But, after all, Dr. Johnson's dictum as to all these changes, and others, is, like most of his decisions, the common-sense truth, "It is more important that the law should be known than that it should be right." See also the articles *PHONOLOGY* and *SPELLING*.

PROOF. See *PRINTING*.

PROOF SPIRIT, a mixture of equal weights of absolute alcohol and water, of which the specific gravity is 0.917; that of the proof spirit of commerce, however, is 0.920 at 60°. The term *proof* has been derived from the now obsolete gunpowder test. If, after spirit had been poured over gunpowder and the vapour inflamed, the gunpowder became fired, the spirit was then termed *over-proof*; if it burnt without igniting the powder, which the residuary water had rendered damp, it was said to be *under-proof*. The weakest spirit capable of firing gunpowder was the proof spirit of pharmacy, specific gravity 0.920.

PROOF-PLANE (Fr. *plan d'épreuve*), a small instrument used for testing charges of frictional electricity. It consists of a small metallic bend, or a small disc of copper, or of gilt paper, fixed perpendicularly at the end of a glass rod, which of course insulates it. If the proof-plane be gently laid on the surface of an electrified body it receives part of the electricity. The proof-plane thus charged may be examined, and the electrical state of the body thus ascertained, as to its positive or negative character, &c. If a proof-plane be inserted into a hollow body, the surface of which is electrified, it will receive no change, for electricity resides on the surface only; in this experiment care is necessary that the proof-plane should pass to the interior freely, without touching the edges of the orifice by which it enters. Another use of the proof-plane is to charge different bodies with exactly the same quantity of electricity, since the proof-plane can carry only a certain quantity, which, under like circumstances, must always be the same. The quantity of electricity which the proof-plane removes from an electrified body is half that lying at the moment upon the spot covered by the disc of the proof-plane, for the quantity of electricity at that point at once divides itself between the two surfaces. The proof-plane is an invention of Coulomb, to whom electricity has owed so much in this kind of way.

PROPAGAN'DA, the name given to an association, or as it is termed, Congregation (*de propagandâ fide*), established at Rome in 1622 by Pope Gregory XV., for the special purpose of extending a knowledge of the Roman Catholic form of Christianity among the heathen, and among the adherents of other Christian systems. The same pope also contributed largely to the funds of the institution, and conferred upon it many important privileges, which have been continued and enlarged by his successors, so that the Congregation now forms one of the most important organizations within the Roman Catholic Church. It is governed by a committee or council of cardinals, which meets periodically under the presidency of the Pope, and it has under its direction all the missionary and proselytizing operations of the Roman Catholic Church throughout the world, with the exception of the Church of the

and it is here that the archives of the Congregation, which

include a valuable collection of historical, ethnographical, and geographical reports collected during a period of two centuries and a half, are preserved. Its chief training college is that named after Urban VIII. at Rome, which forms a general missionary seminary for the whole world. Here students are received from all foreign nations, who are maintained and educated gratuitously from a very early age, and who are required to take a vow at the age of fourteen to devote their whole lives to the work of the missions. Besides this central institution the Propaganda has numerous other colleges under its direction both in Rome and in other countries of the world, and it everywhere encourages as one of the most important stages in a mission the foundation of local seminaries for the training of a native clergy. It possesses considerable property, the result of various endowments, though this has been injuriously affected by recent laws passed by the Italian government in reference to ecclesiastical property, and it receives important contributions from a Roman Catholic Missionary Society, founded at Lyons in 1822, for the propagation of the faith by means of the prayers and alms of the devout. The latter society is now managed by two councils held at Lyons and Paris, and the subscriptions it collects from all parts of the world are distributed in accordance with the suggestions of the Congregation of the Propaganda.

The central college at Rome possesses a valuable library and museum, and one of the best polyglott printing presses in Europe, which produces religious books in fifty or sixty different languages. Its great festival takes place at the Epiphany, when its pupils deliver public recitations in the various tongues which they have studied for their mission work.

PROPER MOTION. The apparent daily revolution of the heavenly bodies is due of course to the actual rotation of the earth in the opposite direction, just as the apparent backward motion of the banks is due to the forward motion of the train. But an examination of the present position of many stars with their recorded position in the past shows a very large proper motion of the stars, as was first pointed out by Halley in his remarks on the three bright stars, Sirius, Aldebaran, and Arcturus, which he showed to be manifestly in other positions than those recorded by Ptolemy and Hipparchos. (The latter of these flourished about 130 B.C.) The change of latitude alone was in each case greater than the moon's apparent diameter. But this kind of observation only gives what one may call the "siding" of the star, and does not show its real motion, which may be considerably towards the earth, or away from it, with very little "siding" indicated. Fortunately spectrum analysis comes in here, and is able quite definitely to declare by the analysis of a star's light whether it is approaching or receding. As time goes on both sets of observations will become more and more valuable, and able to throw light on the fundamental problems of astronomy. Like so many of the other stars the sun himself has a proper motion in space; this is now ascertained (chiefly by the widening out of the stars in that direction, as they are approached) to be towards the star α in the constellation HERCULES.

A remarkable effect of proper motion in changing the face of the sky is graphically illustrated by the changes which are believed to have occurred, and are predicted to occur, in the familiar seven-star group in the constellation of the GREAT BEAR. See the series of woodcuts in that article.

PROPERTIUS, SEXTUS AURELIUS, a native of Umbria, was probably born about 50 B.C. His family was of equestrian rank, and after the campaign of Philippi, when Augustus rewarded his veterans with assignments of lands, was, like many others who had supported the cause of Antony, deprived of their estates. About this time young Propertius went to Rome, where he devoted himself

entirely to poetry, and soon attracted the attention and gained the friendship of contemporary poets, such as Ovid, who always speaks of him with fondness. He also enjoyed the patronage of Mæcenas, and lived on the Esquiline, perhaps in the gardens of his patron himself. It is not known when Propertius died, but probably he did not attain beyond the middle period of life.

Four books of his elegies are extant. In the first three books he sings of his beloved, whom he calls Cynthia; the fourth is chiefly occupied with heroic and religious legends, in which the poet displays his learning. Cynthia's real name was Hostia, and she was a Tiburtine. Propertius' style is artificial, and his writings are often obscure.

The most complete edition of his works is that of P. Burmann, 1780. Recent German editors have done something towards establishing a more correct text, especially Lachmann (Leipzig, 1816). Hertzberg (Halle, 1844) gives excellent and much-needed notes.

PROPERTY is derived, probably through the French language, from the Latin word *proprietas*, which is used by Gaius (ii. 89) as equivalent to ownership (*dominium*). The etymology of the word *proprietas* (*proprius*) suggests the notion of a thing being a man's own, which general notion is contained in every definition of property. A foreign writer defines ownership or property to be "the right to deal with a corporeal thing according to a man's pleasure, and to the exclusion of all other persons."

The definition excludes incorporeal things, which, however, are considered objects of property in our law, and were also considered as objects of property in the Roman law, under the general name of *jura* or *jura in re*. This definition also describes property as consisting in a right, by which word right is meant "a legal power to operate on a thing, by which it is essentially distinguished from the mere possession of the thing, or the physical power to operate upon it. Consequently such a right is not established by the possession of the thing: and it is not lost when the possession of a thing is lost. Such a right can also be enforced by him who possesses the right by an *actio in rem* against every person who possesses the thing, or disputes his right to it." (Mackeldey, "Lehrbuch des heutigen Röm. Rechts," ii. p. 1-36.) This definition may be adopted, with this limitation, that to deal with a corporeal thing according to a man's pleasure, must not be such a dealing as will prevent other people from dealing with their property at their pleasure. The extent of this limitation is very indefinite; but such a limitation must be admitted as necessary. A man may destroy his own property if he likes, but the destruction must not be in such a manner as to destroy any other man's property. By property, then, is here understood that which the positive law of a country recognizes as property, and for the protection or recovery of which it gives a remedy by legal forms against every person who invades the property, or has the possession of it.

The term property in a thing or of a thing signifies the most complete right which the law of any country gives to a man in or to a corporeal thing. If one man has a life estate in land, and another has a vested interest in the remainder or reversion, the remainder-man, or the reversioner, is the real owner, or has the property: the other has only a right to the enjoyment of it limited by the measure of his life, or some other person's life or persons' lives; and his enjoyment of this life interest is also limited by the very nature of the interest, for he must not so use the thing as to destroy it or deteriorate it beyond the amount of deterioration that may be inseparable from enjoyment or use. The degree in which the life-holder's enjoyment may be limited will depend on the positive law of each country.

Yet limited interests in a thing are often comprehended under the term property; and when we wish to express all that a man is worth, all that is capable of an appreciation in money, we speak of this "all" as all a man's "property."

A complete view of property, as recognized, by any given system of law, would embrace the following heads, which it would be necessary to exhaust in order that the view should be complete. It would embrace an enumeration of all the kinds or classes of things which are objects of property, the exposition of the greatest amount of power over such things as are objects of property, which a man can legally exercise, and, connected with this, the different interests which persons may have in a thing which is an object of property; the modes in which property is legally transferred from one person to another, or acquired and lost; the capacity of particular classes of persons to acquire and transfer property as above understood, or, to take the other view of this division, an enumeration of persons who labour under legal incapacities as to the acquisition and loss of property.

The general division of property in the English law is into *things real* and *things personal*, the incidents to which are in many respects different in the system of English law. Things real are comprehended under the terms lands, tenements, and hereditaments. In Scotland the distinction is better known as *heritable* or *movable*.

It has been said that the distinction between legal and beneficial or equitable property is peculiar to the English law (Lord Mansfield, 1 "T. R.," 759, n.) But these two kinds of property existed in the Roman law, and the theory of the division of ownership or property into *quiritarian* (or legal) and *bonitarian* (beneficial or equitable) was fully developed. Its origin in the Roman law is not certain; but it is a probable conjecture that its origin so far resembled the origin of the like division in English law, that it was due to the attempt to get rid of the difficulties attending the alienation of property by the old legal forms. (Gaius, ii. 40.)

Personal property, as understood by the English law, is not sufficiently described by the term "movables," for certain estates in land are personal property, and are comprehended under the term of *chattels real*. [See CHATTELS.] Terms for years are an example of chattels real; and they pass together with the rest of a man's personal estate to the executor.

A quantity of stock in the public funds is not money, though often talked of as such, but still it is property in a sense, for it is a legal right to a perpetual annuity paid by the state, and it is a thing that can be bought and sold. Even debts due to a testator or intestate are considered as property with respect to probate and letters of administration. Yet they are not expressed by the term goods and chattels in the letters of administration, but by the term "credits;" for as debts are not the property of a man to whom they are due until he gets them, so they cannot become property simply because he happens to die.

Property in chattels may, like property in things real, vary as to quantity and quality of interest, though things personal are not capable of such extended and various modifications, analogous to estates, as things real are. As to quantity, that is, duration, a man may have the use of a personal thing for life, and another may have the property in it and the enjoyment after his death. Persons may own a thing, either real or personal, as joint tenants and as tenants in common.

Property in a thing must not be confounded with a faculty or power to dispose of the thing in certain ways. A man may have a power to do a certain act with reference to property, without having any property in the thing; or he may have a property in the thing of a limited quantity, and also a power to dispose of the thing in a certain way. Thus a tenant for life, who has only a limited property in land, may have a power given to him to make leases, subject to certain conditions, of the property of which he is tenant for life, and other powers.

The property which is called Copyright or Patent is not strictly property. It consists in a power to do certain acts, as to produce and sell a certain work or print or machine; and the power or faculty is made effective by the duty imposed on everybody else of abstaining from making and selling such things. The things that are produced by virtue of such a power are objects of property, but the copyright or patent right is merely a power or faculty which is given exclusively to a determinate person or persons for a determinate time. This faculty is called property, because it is a thing that is capable of a money value.

The notion of property is universal, though the particular rules as to property vary in different countries. Society rests on two things chiefly, marriage and the notion of property. The notion of marriage varies in different countries, but there is, perhaps, no set of people among whom it does not exist in some form. It is the foundation of the notion of a family, an essential element of a state. Fixed rules for the acquisition and maintenance of property are essential to the existence of society; and this is true whether people choose to keep their acquisitions separate, or to blend them in any common stock, in any possible and practicable kind of association.

PROPHET, a name derived from the Greek *prophētēs*, which was adopted by the Hellenistic Jews in the translation of the Septuagint, as the rendering of the Hebrew *nābi*, plural *nēbīm*. The original meaning of *prophētēs* was interpreter, and the term was used to designate one who was able to explain to others the divine utterances expressed, but not understood, by the frenzied *mantis* or diviner. In a larger sense it included all who were used as mediums for conveying the messages of the gods to men, whether such messages were delivered consciously and intelligently, or given in dark and broken sayings during an ecstasy. In the mediæval period the word *prophēteia* was used in the sense of prediction, and hence the word prophecy passed into the English language in the sense of foretelling, and this sense it has retained as its popular meaning to the present day. Considered in reference to etymology, however, it is certain that neither prescience nor prediction are implied in the terms used in the Hebrew, Greek, or English languages. Even the other Hebrew names, *roeh* and *chuzeh*, signifying one who sees, and rendered in the Authorized Version by seer, have no special reference to the future, but seem rather to imply that the men indicated possessed a supernatural insight which distinguished them from their fellows.

With respect to the prophets of ancient Israel, their first appearance as a distinct class occurs at the time of Samuel (B.C. 1100), and at a period when the Hebrews were suffering severely from the oppression of the Philistines. Seers there had been from a much earlier period, but these, as already observed, were rather men who rose above their contemporaries by reason of their special sanctity, and who were visited with presents, and consulted on emergencies and special occasions (1 Sam. ix. 1-8). But, under the influence of the Philistine oppression, the people seem to have turned more earnestly to the worship of Jehovah, and the awakened spirit of devotion found vent in the wild excitement of the processions, music, songs, and ecstatic dances of the *nēbīm* (1 Sam. x. 5). This method of expressing spiritual excitement had long been practised by the Canaanite neighbours of the Hebrews, whose worship was often of a wild orgiastic character, and we meet with something of the same kind at a later period, when the prophets of Baal met to contend with Elijah. The existence of the same tendency, accompanied by similar methods of expression, may still be found in the East, and the external phenomena which attended the advent of the *nēbīm* may still be seen in connection with the performances of the dervishes of to-day. The next step in the

history of the prophets seems to have been their union into little communities, under a leader or father, and after this they appear to have been recognized as a standing sacred element in society. The records of early Israel which have been preserved are too brief to indicate clearly the precise place taken in the national life by the "sons of the prophets," but it is evident that they soon absorbed or displaced the ordinary seers; and as early as the time of David we read of Gad the *nabi*, who is also the king's seer. As invariably happens when observances born during a high level of spiritual enthusiasm become part of the regular custom of worship, the special rites of the prophets seem to have undergone considerable degeneration during the history of the nation, and there were long periods through which they seem to have exercised merely the influence of diviners or soothsayers. In the story of the joint invasion of Syria by the allied kings of Israel and Judah (given in 1 Kings xxii.) we read of a preliminary contest between 400 prophets, under a certain Zedekiah, and another prophet, Micahiah, the message of the latter only being justified by the event; and we find Amos disclaiming all connection with the professional prophets of the land, and, like his successors, protesting against their works. At the same time the ranks of the prophets, from the time of Samuel to that of Joel, Amos, Hosea, and the prophets of the later school, included some of the grandest characters of ancient Hebrew history, first among whom stand Nathan, Elijah, and Elisha.

The prophets of the new school, some of whose utterances were committed to writing and afterwards accepted as part of the sacred canon, appear first in the eighth century as religious reformers, protesting both against the religious and moral delinquencies of the people, and the conventional religious observances which had failed to meet the spiritual requirements of the nation. At this period idolatry, attended as usual with foulness and cruelty, had become very common among the people, while there had been developed among the faithful worshippers of Jehovah a higher and clearer apprehension of his righteousness and majesty than had ever been known before. The contrast between the actual condition of Jehovah's people with that which formed the prophetic ideal was so great that the later prophets seem almost to have despaired of the national salvation. The independence of the nation was already threatened by the Assyrian power, and along with their denunciations of the sins of the kings, nobles, priests, professional prophets, and people, we find threatenings of the coming day of Jehovah, in which he should come to judge and condemn his people. Starting from the fundamental propositions that Jehovah was a God of righteousness, and that Israel was specially his people, they repudiated the idea that he was to be propitiated or bribed by offerings and ritual observances, and that men could compound for sin by sacrifice, and they urged repentance and reformation as the only means of averting the impending ruin. An all important portion of their message was also that although Jehovah had chosen Israel as his people, he was not therefore bound to defend and protect them apart from their obedience to his requirements; but rather, seeing he was a God of righteousness, he would be impelled to cut off and destroy those whose conduct was abominable in his sight. Both in the northern and southern kingdoms the prophets formed a party and found supporters, but their influence in the northern kingdom was insufficient to change the tenor of the national life. When that kingdom was conquered by the Assyrians under Shalmaneser, and the people removed into Assyria, the event found the people sunk in polytheism, and so destitute of any true sense of national life that they readily fell into the customs of the people among whom they were placed, freely intermingled with them, and in this way entirely lost all separate existence. In the southern kingdom the pro-

phets laboured with more success, and under their influence important reforms were introduced by which the people became united in the worship of Jehovah. In the reign of Hezekiah a clean sweep was made of much of the idolatry which had hitherto been practised without restraint, and though under Manasseh and Amon a reaction took place, it was followed by a more thorough reformation introduced by the prophetic party in the name of the child-king Josiah. According to many modern scholars it is to this period that we must assign the composition of the Book of Deuteronomy, which is identified with the book of the law said to have been found by the high priest, and which, though previously unknown to king and people, was yet solemnly accepted as the legal and religious code of the nation. Together with these reforms in the public worship of the nation, we are able to observe a great advance in the conception of Jehovah and his relations to men. Instead of regarding him as one deity among others and the especial patron deity of Israel, the people were taught to regard him as the one only God of the whole earth; and the prophets in their visions of the future see not only a reformed and purified Israel, or even a new Israel born of a faithful remnant after the unfaithful portion of the nation had been destroyed, but also a period when the whole earth should be blessed with the knowledge of the true and only God. Hence, when it came the turn of the southern kingdom to follow the northern into captivity, the people had been welded into a nation strong in the possession of a lofty national religion, which rendered them able to withstand all disintegrating influences, and effectually prevented them from becoming absorbed as their brethren had been. In spite of their powerlessness and the long period spent in exile they never gave up the hope of a return or of a re-establishment of the kingdom, and we find the prophet Ezekiel preparing a new code of ritual and religious observance for the temple which should be built. It was under prophetic influence also that the foundations of the latest code of the Jewish law, that now distinguished as the Levitical, were laid, and this code being accepted by the people formed a common tie uniting them into one nation wherever they might be and under whatever circumstances they might be placed. Another point in the teaching of the prophets by which the coming of the new kingdom was identified with a person, a king of the Davidic line, who should reign in righteousness, was afterwards developed into the doctrine of the Messiah, which has formed such an important element in Jewish and Christian theology. See MESSIAH.

Under the influence of the growing reverence for the law and the increase in the power of the priesthood, the voice of prophecy ceased among the Jews during the period which intervened between the return from exile and the break up of the nation, though their visions of the coming kingdom were studied and amplified by the authors of the Apocalyptic writings, one of which, the Book of Daniel, is included in the sacred canon. More interesting to us is the influence they exerted in the development of spiritual religion, in the progress of which their work forms an integral part, and in their lofty monotheism, their vindication of the righteousness of God, and their apprehension of his relations to individual worshippers, as well as to communities and races, they took a most important part in preparing the way for the universal religion of Christianity.

In the New Testament, apart from John the Baptist, we do not meet with any prophet among the Jews, but there are several notices of the existence of an order of prophets in the Christian church. In Acts xi. 27, 28, we read of the visit of a prophet from the Church of Jerusalem to that of Antioch, and in Acts xiii. prophets and teachers are mentioned as among the officers of the church at the latter place at a period antecedent to the first missionary journey of St. Paul. At a later period we are introduced

to women who exercised this gift in the daughters of Philip, mentioned in Acts xxi. 9, while in 1 Corinthians xii. 28, and Ephesians iv. 11, where the officers of the church are enumerated, the "prophets" are placed in the next rank to the apostles. From the foundation of the church down to the end of the second century the prophets were regarded as an essential element in every church which possessed the Holy Spirit. They do not seem to have been elected by the congregations, but were regarded as the subjects of the special inspiration of God, and they ministered either to the church generally by moving about from place to place or settled as preachers to a single congregation. With the growth of ecclesiastical organization and the gradual secularization of the churches, which set in during the latter half of the second century, the vocation of the prophets was called in question, and with the establishment of the episcopal order it gradually ceased to be recognized.

For a full and elaborate account of the prophets of the Old Testament and their place in Jewish history, see Ewald's "Propheten des Alten Bundes" (first edition, 1840-41; second edition, 1867-68; English translation, London, 1876-77); and also "The Prophets of Israel," by W. Robertson Smith (Edinburgh, 1882). For a study of the prophets of the Christian Church see Harnack's "Die Lehre der Zwölf Apostel" (1884, pages 98-137).

PRO'PIONE, or META'GETONE, is the ketone of propionic acid. It is formed when sugar, starch, or gum is distilled with excess of lime. It is a colourless liquid, insoluble in water, but soluble in alcohol and ether. It boils at 101° C. (214° Fahr.) The formula is $C_6H_{10}O$.

PROPIONIC or METACETON'IC ACID. This acid is found in sour cocoa-nut milk. It is formed artificially by several reactions. It can be produced direct from carbonic acid by the action of sodium ethyl, and is interesting as being the first organic compound so obtained. It boils at 140° C. (284° Fahr.), and is soluble in water. The formula is $C_3H_5O_2$. It has a very peculiar odour. It forms a series of salts, having the general formula $C_3H_4NO_2$. Propionic ether, C_3H_7 (C_3H_5) O_2 , is a light liquid, having a fruity odour. By the action of ammonia it yields propionamide (C_3H_7NO). Propionic aldehyde (C_3H_6O) is a liquid of ethereal odour, having a specific gravity of 0.79.

PRO'POLIS is a resinous substance collected by bees from the buds and wounds of various trees, and used by them in the construction of their combs. See *BEES*.

PROPORTION. There must be in the mind of every person, antecedently to all mathematical instruction, a perfect perception of proportion, though not perhaps of the manner of measuring magnitudes with a view to express their proportions by means of numbers. All who can trace the resemblance of a drawing to the original, or have the least notion of the use of a map, are in possession of the fundamental notions on which a theory of proportion can be founded. The ratio or relative magnitude of two magnitudes is to be measured by the number of times or parts of times which one is contained in the other.

If all magnitudes of the same kind were necessarily commensurable—that is, if any one among them being taken as a unit, the rest were all expressible by multiples, aliquot parts or submultiples, and multiples of aliquot parts, of the unit chosen—no difficulty would arise in making the subject of proportion purely arithmetical, but this we are soon constrained upon examination to admit, since many magnitudes are perfectly incommensurable.

The discovery of incommensurable magnitudes, one of the most striking triumphs of reason over the imperfection of the senses, was made at a very early period; since the demonstration of their existence the classification (to a certain extent) of their species, and the means of overcoming the difficulties which they present, appear in the writings of Euclid (Eukleidēs, who flourished at Alexandria

about 800 B.C.) A moment's consideration will show that a property of numbers, a relation of figure in geometry, a general law of nature, may be inferred from induction with a degree of probability which will amount to moral certainty, both as to the exactness and universality of the property, relation, or law. But the existence of incommensurable magnitudes can never be made certain, except by absolute deduction: no attempt at measurement could show the non-existence of any common measure. Suppose, for instance, that having provided means of measurement which can always be depended on to show the thousandth of an inch, but nothing less, a person should accurately lay down squares of 1, 2, &c., inches in the side, with a view to prove the non-existence of a common measure to the side and diagonal (which geometers know to be incommensurable). If not before, he would be baffled by the square whose side is 2378 inches, the diagonal of which could not by his measures be distinguished from 3363 inches, from which it differs, however, by about the five-thousandth part of an inch. And let any greater degree of exactness be attained in the means of measurement, short of positive accuracy, a reasoner on the subject could still predict a square which should defeat the object sought to be attained.

The mere existence of incommensurables, to say nothing of their frequent occurrence and the impossibility of avoiding them, renders the arithmetical theory of proportion inexact in its very definition. If we would say, for instance, that the diagonal of a larger square is to its side as the diagonal of a smaller square is to its side, we enunciate a proposition the meaning of which is unsettled. For if we mean to assert that the larger diagonal contains the larger side as many times or fractions of times as the smaller diagonal contains the smaller, it is answered by those who wish for precise notions, that neither diagonal contains its side any exact number of times or parts of times. If we should prove that the larger diagonal lies between 1.414213 and 1.414214 times the larger side, and that the smaller diagonal also lies between 1.414213 and 1.414214 times the smaller side, we certainly show that we could produce lines very nearly equal to the diagonals, which are, under the arithmetical definition, proportional to the sides; and if we use the means by which this process may be carried on *ad infinitum*, we may perhaps be said to have established the truth of the proposition, that the diagonals of squares are as their sides.

But since this endless labour is absurd and unnecessary, the imperfection of the arithmetical definition of proportion is universally admitted. The complexity of the rigorous geometrical definition by which Euclid supplied its place is, however, almost as universally felt to be a grievance. Many attempts have been made to avoid the trouble without incurring the reproach of inaccuracy.

The definition of proportional quantities given by Euclid is as follows:—"Magnitudes are said to have the same ratio to one another, the first to the second and the third to the fourth, when equimultiples of the first and third, and equimultiples of the second and fourth, whatever the multiplications may be, yield a multiple of the first greater than, equal to, or less than that of the second, according as the multiple of the third is greater than, equal to, or less than that of the fourth." That is, if A, B, C, and D be the four magnitudes, and m and n any two whole numbers whatsoever, mA must be greater than, equal to, or less than nB , according as mC is greater than, equal to, or less than nD . Otherwise thus, whatever whole numbers m and n may be, A must exceed, equal, or fall short of n -mths of B , according as C exceeds, equals, or falls short of n -mths of D . An algebraist would comprehend the definition most easily when stated thus: $mA - nB$ must have the same sign as $mC - nD$ for all whole values of m and n .

The definition equally applies whether A and B be

commensurable or incommensurable, since no attempt is made to measure B by an aliquot part of A. (See Playfair's "Euclid," with notes: Barrow's "Mathematical Lectures;" and De Morgan "On the Connection of Number and Magnitude.")

If four quantities be proportional, so that a is to b as c is to d , which is usually expressed by the forms

$$a : b :: c : d \quad \text{or} \quad \frac{a}{b} = \frac{c}{d},$$

then $a : b$ is the antecedent ratio, $c : d$ is the consequent ratio, and what is predicted is the equality of these ratios:— a, b, c, d are called terms; a the first term, b the second, &c.; also a and d are the extremes, and b and c are the means. Many results follow.

For if $\frac{a}{b} = \frac{c}{d}$, as it does by hypothesis, then multiplying both sides of the equation by bd it is evident that $ad=bc$, which is to say that the product of the extremes equals the product of the means. Therefore we can always find a fourth proportional to three terms, for if we multiply the means and divide by the one extreme, the result is the other extreme. Thus $d = \frac{bc}{a}$. Upon this is based the

well-known "Rule of Three" of the arithmetic books. Of course any term (and not merely the fourth term) can be obtained as easily; for

$$a = \frac{bc}{d}, \quad b = \frac{ad}{c}, \quad \text{and} \quad c = \frac{ad}{b}.$$

Conversely, if the product of two quantities is equal to the product of two others, these four are proportionals; example, 4 times 6 = 3 times 8; whence we see that 3 is to 4 as 6 is to 8.

Further, if $a : b :: c : d$, then also $b : a :: c : d$ (inversely); and again $a : c :: b : d$ (alternately); and still again $a + b : b :: c + d : d$ (componendo); and also $a - b : b :: c - d : d$ (dividendo); and similarly $a : a - b :: c : c - d$ (convertendo); while the combination of these is also true, namely, $a - b : a + b :: c - d : c + d$.

We can multiply or divide a series of proportionals, multiplying or dividing either the ratios, or the alternate terms, and the proportion remains undisturbed;

For if $a : b :: c : d$,
then also $ma : mb :: nc : nd$,
and $ma : nb :: mc : nd$.

Also $\frac{a}{m} : \frac{b}{n} :: \frac{c}{n} : \frac{d}{n}$,

and $\frac{a}{m} : \frac{b}{n} :: \frac{c}{m} : \frac{d}{n}$.

Also $a^2 : b^2 :: c^2 : d^2$,

and $\sqrt{a} : \sqrt{b} :: \sqrt{c} : \sqrt{d}$,

and so on for all other powers and roots.

We can also combine proportionals, so that if we have

$a : b :: c : d$,
and also $e : f :: g : h$,
we can say that $ae : bf :: cg : dh$.

It needs only to be noticed that in all these ingenious terms we have assumed that all four of the proportionals are of one kind—all numbers, or all trees, or all lines, &c. If, however, a ratio of trees be compared with a ratio of circles, as when we say 3 trees are to 4 trees as circle A to circle B, it is manifest that many of these changes are impossible, for one cannot express the ratio of a tree to a circle.

PROPORTIONAL PARTS, a name given in logarithmic and other tables to small tables which are annexed

to the differences of the tabular number, and which consist merely in setting down the several tenths of the differences or the nearest whole numbers to them. Thus, in the case of 953, the table of proportional parts is as follows:—

953	
1	95
2	191
3	286
<hr/>	
4	381
5	477
6	572
<hr/>	
7	667
8	765
9	858

Thus, 286 is the whole number nearest to 3-tenths of 953; from which we infer that 29 is the whole number nearest to 3-hundredths of 953. If, then, we would have .74 of 953 to the nearest whole number, we take

7-tenths, . . .	667
4-hundredths, . . .	38
<hr/>	
	705

or 705 is the nearest whole number required, subject to the possibility of an error of a unit, which is of no consequence in the matters for which such tables are used. This is the process required in logarithmic interpolation, when tables of seven decimal places are used.

PROPOSITION, a statement of fact. Every proposition must have two parts:—(1) the *subject* or name of that about which the fact is to be asserted (or denied); and (2) the *predicate* or assertion (or denial) of the fact relative to the subject. Connecting these two parts is found (or implied) the *copula*, which is the word *is* or the words *is not*, or some number or tense-modification of these (*are, was, is to be, &c.*) Thus, in "John walks," *John* is the subject, *is* is implied, and *the act of walking* is the predicate. The nature of a proposition is best stated in the definition that it is the result of an act of judgment. To a civilized man it is impossible to make a judgment without formulating it in words either spoken or thought.

The conduct and examination of propositions is one of the greatest divisions of logic, for upon the right ordering of propositions the whole fabric of reasoning depends. The subject is as fully treated as space allows in the article LOGIC.

PROPRÆTOR, PROCONSUL, in the Roman administration, officers possessing the duties and honours, but not the office, of consul or prætor. At the expiration of a consul's or a prætor's term of office, his command was prolonged under the title of proconsul or proprætor. Under the empire proprætors, as distinguished from proconsuls, were appointed to the government of the imperial provinces.

PROPYLEUM (or more correctly *Propylæion*, signifying literally a fore-portal or one detached from and placed in advance of the building to which it gives access) is used as a distinctive term for the structures through which persons passed into the inclosure surrounding some of the Grecian temples.

The general arrangement and character of a Greek propylæum may be best explained by a description of that of the Akropolis at Athens. It was of the Doric order, and hexastyle on both fronts; and the outer front was greatly extended by two flanking wings projecting forward at right angles, so as to inclose the platform, to which an ascent of steps led up from below, and above which the portico and the two lesser colonnades forming the sides of the wings were raised upon three other steps. Thus the platform

(78 feet from north to south by 40 east and west) became an elevated open forecourt, presenting a principal portico in front, crowned by a pediment and two colonnades, which being considerably lower (their columns 19 feet, the others 28½ feet high) gave greater importance to the former; and a degree of scenic effect, combination, contrast, and variety was produced very unusual in Grecian architecture.

PROBATION. See PARLIAMENT.

PROSA (Eng. *prose*), the usual mediæval name for the long Latin hymns, of which "Lauda Sion," "Dies Iræ," and "Stabat Mater" are examples known to every one, which are now usually called sequences. [See SEQUENTIA.] The reason a sequence was called a *prose* was because it was written not in classical language and metre, but in popular speech and accented rhymed verse—to mediæval ears not true verse at all, but jingling doggerel. A comparison of a few lines of Virgil or Horace with the hymns named will clearly show the difference. Still it seems odd to modern ears, until the etymology of the word is examined, that rhymed verses should be called *par excellence* "*prose*." The word *prose* comes from the Lat. *prosa oratio*, i.e. direct speech, that is, unembellished speech or popular speech, free from the turgid diction of the formal literary language, which had become a dead tongue, apart from the (Latin) language of the day.

PROSCENIUM (Gr. *proskénion*; from *pro* and *skênê*, a tent or scene), in architecture, the part in a theatre where the *pulpitum* stood, into which the actors came from behind the scenes to perform, and where the drop scene separated the stage from the audience. It was situated beyond the orchestra, and in ancient theatres comprised the whole of what we call the stage. In modern usage the word means the frame in which the drop-scene is set, the partition cutting off the stage from the auditorium.

PROSCRIPTION, the name given to a list of outlawed persons at the time of the close of the republic of ancient Rome. Such lists were the products of the fierce conflicts between the senatorial aristocracy and the democracy, which wrecked the republic and paved the way for the empire. It was Sulla who began the horrible custom. After the second revolution against his authority, in B.C. 82, he condemned all those who would not make their peace with him, after he had become absolute dictator, to outlawry. Whoever killed one of the proscribed was rewarded with an execution fee of 12,000 denarii (say £188); whoever befriended one of them was punished with the extremest severity. The property of the proscribed went wholly to the state, and his family was degraded from ability to hold office. The most terrible thing about this first proscription was that no man knew when he was safe; and upon this being represented to Sulla he ordered the lists to be fully written out and posted, and to be closed on a certain date (1st June, 81 B.C.). In all 4700 names were put upon this bloodstained roll, and at least £3,000,000 worth of landed estates (350,000,000 sesterces) were confiscated.

The other famous proscription, by Antony, Octavian (Augustus), and Lepidus, 43 B.C., was still more searching and cruel. It had a ghastly feature in the fact that the triumvirs mutually surrendered friends and relatives; thus Octavian gave over to Antony's revenge his friend Cicero, on condition of Antony marking down his uncle, Lucius Cæsar, whom Octavian hated. Lepidus bartered his own brother Paulus, an enemy of his colleagues, for some one whose death was necessary to glut his own hate. Three hundred senators, 2000 equites, and a very large number of persons in all were upon this terrible list.

When Octavian came to the supreme power he strained every nerve to throw the blame of the proscription on Mark Antony, and to a great extent he succeeded. It ill accorded with the subtle policy of this wonderfully clever

schemer that he should be held to be a man capable of cold-blooded cruelty such as he had joined in with his brother triumvirs.

PROSELYTE (Gr. *proslûtês*), a term used by the translators of the Septuagint to represent the Hebrew *ger*, which is commonly rendered in the Authorized Version "stranger." In all the earlier periods of Hebrew history we find recognition of the existence of certain persons, not of pure Hebrew stock, but who dwelt among the Hebrews and conformed to their religious usages. Such persons being outside the family clans would be specially liable to oppression, and hence we find both in the Law and the Prophets frequent injunctions in their favour. In the periods of Jewish history subsequent to the exile, the term *proselyste* is used to designate those who, from various motives, were led to embrace the Jewish religion, and who were divided into two classes—*proselytes* of the gate, and *proselytes* of righteousness or of the covenant. The former were not circumcised, and were not required to observe more of the law than the seven precepts of Noah; but though they were promised by the rabbis a share in Paradise, they were forbidden to study the Mosaic law, or to claim the special privileges of Israel upon earth. The *proselytes* of righteousness were those of foreign birth, who accepted the initiatory rite of circumcision, solemnly and publicly vowed to obey all the requirements of the Mosaic law, and who were in consequence admitted as full members of the Jewish nation. One of the ceremonies through which a convert passed was baptism by immersion, but it is a disputed point as to when this usage originated, i.e. whether it preceded or followed the introduction of Christianity. The most probable opinion is that which places its origin earlier than the time of John the Baptist, and which regards as the special feature of John's baptism the circumstance that it was administered to those who were already members of the Hebrew community.

For a period considerably earlier than New Testament times the Jews had been very zealous in proselytizing, and we find from the account of Josephus that John Hyrcanus commanded the Idumæans to accept circumcision under pain of death or exile, and that a similar alternative was offered to the Itureans by Aristobulus ("Antiquities," xiii. 9, § 8, and *ib.* xiii. 11, § 3.) The milder methods of preaching and teaching were practised by the Jews wherever they were located throughout the world, and there are many references to their zeal in this work to be found in Greek and Latin writers. In many instances the converts to Judaism were persons who had become dissatisfied with philosophy or heathenism, and who were attracted by the elements of antiquity and spirituality to be found in the Jewish system. Others became converts from baser motives, and some of them seem merely to have added the vices of Judaism to the vices of heathenism. Converts of this class, together with those who sought to make them, are sternly denounced by Jesus in Mat. xxiii. 15. Although eager to make *proselytes*, the motive animating the Jews seems rather to have been the glorification of their race than the hope of conferring any benefit upon the converts gained. The latter, when made, were treated with very scanty respect, and the sentiment of the ordinary Englishman towards a converted Jew to-day represents not inaptly the feeling of the Jews towards those whom they had gained. Probably it was the existence of this feeling which led the writers of the New Testament to avoid the use of the term *proselyste*.

PROSERPINE or **PROSERPINA**, called by the Greeks *Persephônê*, was the daughter of Zeus and *Démêtêr*. She was carried off by Pluto while gathering flowers in the Nyseian plain, and made the queen of the dead. See *PERSEPHONE*.

PROSO DY (Gr. *prosôidia*) is derived from a Greek word, which has exactly the same meaning as the Latin *accentus*, and was used by the Greeks in the same sense.

Most modern writers, however, make a distinction between prosody and accent, understanding by the former what is usually called *quantity*, that is, the duration of a sound. Thus it is said that the principle of Greek and Roman versification is *quantity*, while that of the poetry of the modern European languages depends on *accents*. It is not, however, improbable that what the ancients meant by *quantity* was not very different from what we call *accent*. Various attempts have been made, with more or less success, to introduce the ancient metres into English poetry. We may refer to Clough's and Longfellow's hexameters, and to some of Tennyson's metrical essays. They do not seem to harmonize, however, with the spirit of our language, or to recommend themselves to the public ear.

PROSO'PIS is a genus of leguminous plants of the suborder MIMOSÆ, belonging to warm countries, and distinguished by having their pods filled in between the seeds with a pulpy or mealy substance. The Algarobo (*Prosopis dulcis*) of Central and South America is employed as food for cattle, and is sometimes cultivated for the sake of its sweet succulent pods. *Prosopis glandulosa*, the mesquit of Texas, a tree 30 feet high, yields a good, hard, durable timber, and also affords a large quantity of gum resembling gum-arabic. Tannin is extracted from the pods of several species. The species are trees or shrubs with bipinnate leaves and small sessile flowers, collected in heads or spikes.

PROTAG'ORAS, one of the earliest of the Greek Sophists, was born at Abdera in Thrace, about 480 B.C. He is said to have been originally a porter, and to have been relieved from this menial occupation by Demokritos. But the story seems to have arisen out of the statement of Aristotle that Protagoras invented a sort of porter's knot for the more convenient carrying of burdens. The Sophists were a class of teachers and thinkers who made their appearance at the time when the great colonial philosophies, the Ionic, Pythagorean, and Eleatic, were on the wane—i.e. about the middle of the fifth century B.C. They stood between the older philosophers and Sokrates and Plato during a period of great intellectual excitement, of which they were both the effect and the cause. They were the first who took payment for their lessons. They undertook to instruct the rising generations in all useful accomplishments, and particularly in the art of rhetoric; and it is probable that to a large extent they made good their professions. The saying of Protagoras, that "man is the measure of the universe," contains the marrow of their philosophy. It meant that our individual judgments and feelings were the standard of the true and false, of the right and wrong; that whatever each man regarded as right *was right*, and that whatever he regarded as true *was true*—a doctrine which obviously unsettles the foundations both of truth and of morality, and opens a wide door to every form of ignorance and licentiousness. But the ultimate principle of the fallacies of the Sophists was their assumption that *sensation* is the essential attribute of man. In assuming this as their principle, Protagoras and the Sophists appear to have forestalled the whole of the English and French philosophy which in the eighteenth century arose out of the doctrines of Locke. Protagoras died about 411 B.C.

PROTEA'CEÆ is an order of plants belonging to the group MONOCHLAMYDEÆ. The species are numerous, natives chiefly of Australia and of South Africa. They are shrubs or small trees with hard, dry, exstipulate leaves, which are opposite or alternate. The perianth is four-parted, valvate; the stamens are four, opposite to the segments of the perianth; the ovary is superior, one-celled, with one, two, or many ovules; the fruit is dry or succulent, dehiscent or indehiscent, often collected into a kind of cone. The plants flourish in stony, exposed, and barren places, especially near the sea-coast. Several species are cultivated in gardens and greenhouses. Some of the

larger species afford good timber, and the fruit and seeds of others are eaten. The chief genera are *Protea* and *Banksia*.

PROTECTION. See FREE TRADE.

PROTECTIONISTS. This was the name given to that section of the Conservative party which, in 1844, formed a Society for the Protection of Agriculture, and resisted all attempts to repeal the corn laws. Their leader was Lord George Bentinck. The society was dissolved in 1853, when it was found that the Derby Conservative administration did not intend to propose the restoration of the corn laws. The system of protecting certain branches of domestic industry, by prohibiting the importation of the produce of such industries from abroad, or loading it, when imported, with heavy duties, was at one time universally prevalent, and it is still adhered to in some countries, although it has long since been abandoned in England—its injurious influence having been demonstrated over and over again. During a depression of trade in 1869-70 an agitation was commenced to revive the practice under the modified names of "reciprocity" or "fair trade," but the movement did not meet with the support of a single person having the least claim to statesmanship, and failing to obtain popular support it gradually died out. There is a free-trade party to be found in most of the countries where protection is the rule, and hence in these countries the terms "protectionist" and "free trader," or their equivalents, still form part of the recognized political vocabulary.

PROTECTOR, in English history, a title which has been thrice adopted by eminent statesmen—(1) by Richard, duke of York, in 1453, with the authority of Parliament; (2) by the Duke of Somerset, on the authority of a patent obtained from Edward VI., in 1548; and (3) Oliver Cromwell assumed the title of Lord Protector of the Commonwealth of England, Scotland, and Ireland, on 12th December, 1653. His son Richard succeeded to the office, but was never formally installed or recognized.

PRO'TEIDS or **ALBU'MINOIDS**, the most important class of the nitrogenous compounds which form the solid tissues of the bodies of animals, one or more of them entering into the composition of every living tissue. Taken in general the composition of proteids is about as follows (Hoppe-Seyler):—

Carbon,	51.5 to 54.5
Hydrogen,	6.9 to 7.3
Nitrogen,	15.2 to 17.0
Oxygen,	20.9 to 23.5
Sulphur,	0.3 to 2.0

All proteids are amorphous and non-crystallizable, unable, therefore, to pass with any readiness through animal membranes. They are soluble, but undergo alteration in composition in strong acids and alkalies; some are soluble in water, others in neutral saline solutions or dilute acids, a few in alcohol. There are five readily distinguishable classes of proteids—*Albumens* native, *Albumens* derived, *Globulins*, *Fibrin*, and *Peptones*. Of these the native albumens are egg-albumin or **ALBUMEN** and serum-albumin, differing in that the latter is soluble in ether. Serum-albumin is found in the blood and the tissues generally, and is the form of albumen found in albuminuria or Bright's disease. The derived albumens are the altered forms of the native albumens under acids and alkalies, and are therefore divisible into acid-albumen (or **SYNTOBIN**) and alkali-albumen (or **CASEIN**). **GLOBULIN**, **FIBRIN**, and **PEPTONES** are treated of under those headings.

Proteids do not exhaust the nitrogenous compounds of the animal body. The chief class of the non-proteids is the **GELATINS**, comprising *Gelatin*, *Mucin*, *Elastin*, *Chondrin*, and *Keratin*; but the division has to be very arbitrary, and is often difficult to make clear. Certainly in solubility proteids and gelatins differ very markedly, but other tests do not point out such great distinctions. On the whole it

seems likely that we are on the verge of a larger generalization, which will include all the nitrogenous animal compounds, or of a new classification of them. Other nitrogenous classes are the products of disintegration (the UREAS, &c.), and the ferments of the body (PTYALIN, PEPsin, &c.); these are elsewhere described.

PROTEIN is potassium albuminate. It is formed by the action of potash on any albuminous substance. The body enters into solution, and when an acid is added the so-called protein is precipitated. Mulder gives the centesimal composition of this substance as—carbon, 54·6; hydrogen, 6·9; nitrogen, 15·6; but it is not a definite body.

PROTEST, a term of commercial law. Sometimes it is better to do certain acts—as, for instance, to pay a disputed sum—and to fight out the right of the matter after: in this case the payer pays, or the signatory signs, S.P., i.e. *supra protest*.

When a bill is dishonoured the merchant holding it protests through a notary public against the injury done him. The notary presents it anew with certain formalities, and if then dishonoured issues a *protest* in a certain legal form. The English method of “noting,” that is, a formal notice sent to the culpable endorser by the notary, is sufficient for home bills; but foreign bills must be protested in the presence of two witnesses and in a more definite document, setting out the bill protested and other facts of the case.

A third meaning of protest is that statement which a captain makes (usually to a public notary) within twenty-four hours of his arrival in port when either he has met with some accident or has had to put into a port not named in his papers. The failure to record such a definite statement has very serious consequences, both to the captain himself and as regards the marine insurance upon the vessel and her cargo.

PROTESTANT, a general term comprehending all who profess Christianity and are not in the communion of the Church of Rome. There is a great variety of opinion among the persons thus separated in points of faith, church order, and discipline, but this term comprehends them all.

The name originated in Germany. At the diet at Spire, in 1526, decrees had been passed which were so far favourable to the progress of the Reformation that they forbade any peculiar measures against it. [See SPIRES.] The consequence was, that the spirit of reformation gained strength, and spread itself more extensively in Germany. Then arose also commotions which were attributed to the reformed and to the spirit kindled by them. Both the pope and the emperor looked with increasing alarm on the aspect of affairs; and at another diet, held at the same place in 1529, the latter directed an imperial brief to the persons assembled, to the effect that he had forbidden all innovation, and proscribed the innovators in matters of religion, who had very considerably increased since the decrees of 1526, but that now, by virtue of the full powers inherent in him, he annulled those decrees as contrary to his intentions. The peremptory tone of these letters alarmed the persons who were present at the diet.

This strong measure of the emperor had also the effect of uniting, at least on this point, the two great sections of the German reformers, the Lutherans and the Sacramentarians, of whom Zuinglius was the head. However, the party opposed to the Reformation was the stronger, and the emperor's brief received the sanction of the diet. Thereupon the reformers declared that this was not a business of policy or temporal interests, with respect to which they were ready to submit to the will of the majority, but it affected the interests of conscience and futurity. On this and other grounds they founded a *protest*, which was delivered in on the 18th day of April, but refused by the

rest of the diet. A second protest, larger than the former, was presented on the succeeding day. The princes and the cities who favoured the Reformation joined in it, and thenceforth it became usual to call the reformers *Protestants*.

Since the period of the Reformation it has been customary to include in the term Protestant certain small Christian communities older than the Reformation, but agreeing with it in repudiating the claims of supremacy advanced by the Roman see, and in the ordinary use of the term all Christians outside the pale of the Greek and Roman churches are classed as Protestants. The term was also accepted without cavil by the Anglican Church until a recent period; but since the Oxford movement many Anglicans have strenuously rejected the designation, and the members of the High Church or Ritualist party take every available opportunity to denounce this use of the term as inaccurate, both on historical and doctrinal grounds.

Using the term in its generally accepted sense, some recent computations show that the Protestants now number—

In Europe,	81,000,000
In America,	34,000,000
In Asia and Australasia,	3,300,000
In Africa,	850,000

Total, 119,150,000

PROTEUS, in the Greek mythology, an old man of the sea (Gr. *aios gerôn*), who tended the flocks (seals) of Poseidôn, and rose at mid-day from the deep to sleep upon the shore, surrounded by ocean monsters. His favourite residence was either Pharos or Karpatothos. To obtain his prophecies of the future, it was needful to surprise Proteus during his slumbers, and to hold him fast until he had exhausted all his powers of transformation.

PROTEUS is a genus of amphibians belonging to the order URODELA, and to that section of it (Perenni-branchiata) in which the gills persist throughout life. There is only one species, *Proteus anguinus*, inhabiting the subterranean lakes and caverns of Carniola and Dalmatia. This remarkable amphibian is about a foot in length, with a cylindrical flesh-coloured body and a tuft of branchiæ on each side of the neck, of a blood-red colour. The limbs are small and the fore feet have three toes, while the hind have only two. The snout is long and truncated. The eyes are very small and covered by the skin. There are two gill-slits on each side of the neck. Besides the persistent gills rudimentary lungs are present. The characters of the skeleton show the extremely low position of Proteus among living amphibians. In the backbone the vertebrae are biconcave, like those of most fishes, but much of the notochord remains unossified. There are fifty-eight vertebrae, of which twenty-eight belong to the region of the tail. The carpus and tarsus are unossified. The red blood-corpuscles are the largest known among vertebrates. The Proteus feeds on worms and small fishes. It has bred in captivity.

PROTHESIS, that variation in words as they pass from one nation to another in the course of time, whereby they acquire an additional letter or letters at the beginning. It is therefore the exact converse to PARAGOGUE. Examples of prothesis are *s-melt* (melt), *s-plash* (plash), *s-stop* (stop), *s-cratch* (for the true form *cratch*, obsolete).

PROTOCOL, in diplomacy, is the original copy of a treaty, despatch, or any other document; in a more general sense, the minutes or rough draft of a transaction; in Scotland, the record or book in which every notary is bound to preserve copies of all the deeds and instruments which he may at any time execute. The word is a late Greek barbarism *prôto kollon* (*prôtos*, first, *kolla*, glue), first-glued, that is, a first leaf or title page stuck on to a volume

of MS. and bearing the title, the names of the transcribers, and oftentimes a brief summary or table of contents.

PROTOGENES, a famous Greek painter and rival of Apelles, about 330 B.C. He was a native of Kaunos in Karia, or of Xanthos in Lycia; but as he lived at Rhodes, the former was more probably the place of his birth. He was originally a ship painter, but eventually was one of the most distinguished of all the Greek painters for the finish of his works, on which he bestowed extraordinary labour. Protophēns is said to have devoted seven years to a picture of "Ialuso and his Dog;" and when Demétrios was besieging the city of Rhodes, in 304 B.C., he respected a certain part of the city for fear he might injure this celebrated picture, known to be in that place. The foam of the dog's mouth in this picture had especial fame. This "Ialuso" was some centuries later burnt at Rome in the fire which destroyed the Temple of Peace, where it was preserved.

PROTOPLASM, the name now generally used to designate the living matter from which all kinds of living beings are formed and developed, and to the properties of which all their functions are ultimately referred. The modern knowledge of the subject is generally attributed to the observations of the French naturalist Dujardin, made about 1835, which drew attention to the fact that the bodies of some of the lowest members of the animal kingdom consist of a structureless, semifluid, contractile substance, to which he gave the name of *sarcode*. A similar substance occurring in the cells of plants was afterwards studied by Hugo von Mohl, and named by him *protoplast*. It remained for Max Schultze to demonstrate that the sarcode of animals and the protoplasm of plants were identical; and by Professor Huxley it has been shown that this same protoplasm lies at the base of all the phenomena of life, whether in the animal or the vegetable kingdom.

In reference to the protoplasm of the vegetable kingdom, as is generally known, the common nettle owes its stinging property to the innumerable stiff and needle-like, though exquisitely delicate, hairs that cover its surface. Each stinging needle tapers from a broad base to a slender summit, which, though rounded at the end, is of such microscopic fineness that it readily penetrates and breaks off in the skin. The whole hair consists of a very delicate outer case of wood, closely applied to the inner surface of which is a layer of semifluid matter, full of innumerable granules of extreme minuteness. This semifluid lining is protoplasm, which thus constitutes a kind of bag, full of a limpid liquid, and roughly corresponding in form with the interior of the hair which it fills. When viewed with a sufficiently high magnifying power, the protoplasmic layer of the nettle hair is seen to be in a condition of unceasing activity. Local contractions of the whole thickness of its substance pass slowly and gradually from point to point, and give rise to the appearance of progressive waves, just as the bending of successive stalks of corn by a breeze produces the apparent billows of a corn-field. But in addition to these movements, and independently of them, the granules are driven, in relatively rapid streams, through channels in the protoplasm which seem to have a considerable amount of persistence. Most commonly the currents in adjacent parts of the protoplasm take similar directions, and thus there is a general stream up one side of the hair and down the other. But this does not prevent the existence of partial currents, which take different routes; and sometimes trains of granules may be seen coursing swiftly in opposite directions within a twenty-thousandth of an inch of one another; while occasionally opposite streams come into direct collision, and after a longer or shorter struggle, one predominates. Currents similar to those of the hairs of the nettle have been observed in a great multitude of very different plants, and they probably occur in more or less perfection in all young vegetable cells.

Though it is certain that all these phenomena are in re-

sponse to some stimulus exerted on it by the outer world, they are such as we never meet with in a simply physical fluid—they are spontaneous movements resulting from its own proper irritability, from its essential constitution as living matter. High microscopic power discovers the granules, but nothing to which the term organization can be applied. But though this glairy, tenacious fluid is totally devoid of structure, yet no one who contemplates the spontaneously moving matter can deny that it is alive. Liquid as it is, it is a living liquid; organless and structureless as it is, it manifests the essential phenomena of life.

In a stage a little higher in protoplasmic development is the famous *amoeba*, for which ponds and pools, and gutters on the house-roof, have been ransacked ever since the commencement of microscopic observation. Many a time within nearly 200 years past has the microscopist stood in amazement at the undefinable form and Protean changes of this little particle of living matter. It is only the science of our own days, however, which has revealed its true biological importance, and shown that *amoeba* consists of protoplasm in the simplest form of organized life. We have in it, in fact, a sample of unicellular organisms, that is, a body consisting of a single cell—the smallest unit of organized life. The term "cell" conveys the incorrect notion of a hollow body or vesicle, but its meaning essentially is, a definite mass of protoplasm having a nucleus imbedded in it. Let us observe our *amoeba* a little closer. Like all living beings, it must be nourished. It cannot grow as a crystal would grow, by accumulating on its surface molecule after molecule of matter. It must feed. It must take into its substance the necessary nutriment; it must assimilate this nutriment, and convert it into the material of which it is itself composed. If we seek, however, for a mouth by which the nutriment can enter its body, or a stomach by which this nutriment can be digested, we seek in vain. Yet watch it for a moment as it lies in a drop of water beneath the microscope. Some living denizen of the same drop is in its neighbourhood, and its presence exerts on the protoplasm of the *amoeba* a special stimulus, which gives rise to the movements necessary for the prehension of nutriment. A stream of protoplasm instantly runs away from the body of the *amoeba* towards the destined prey, envelops it in its current, and then flows back with it to the central protoplasm, where it sinks deeper and deeper into the soft yielding mass, and becomes dissolved, digested, and assimilated in order that it may increase the size and restore the energy of its captor. But again, like all living things, *amoeba* must multiply itself, and so, after attaining a certain size, its nucleus divides into two halves, and then the surrounding protoplasm becomes similarly cleft, each half retaining one-half of the original nucleus. The two nucleated masses which thus arise now lead an independent life, assimilate nutriment, and attain the size and characters of the parent.

The *amoeba* is thus of great importance as supplying us with the type of the cell, the morphological unit by the aggregation of which all the higher animals are made up. While the *amoeba* is an animal consisting of a single cell, a unicellular organism, the higher animals are multicellular organisms, whose bodies consist not of one, but of a vast number of cells, primitively all alike, but in the course of development undergoing various changes both of form and function, fitting them for the divers purposes they are destined to fulfil.

In its earliest condition the body of one of the higher animals, of man himself, consists, like the *amoeba*, of a single cell—the ovum; in each case this single cell divides into two; but while in the *amoeba* the two cells thus formed separate at once as two *amoebæ*, and henceforth lead completely independent existences, in man and in all the higher animals the two cells remain in contact with one

another; each again divides, and so we get a body consisting of a small heap of cells, all alike, out of which, by a slow process of differentiation, accompanied by constant formation of new cells, the embryo is gradually formed.

Even in the adult condition of the higher animals, many of the individual cells of which the body is composed retain their individuality in a form reminding us in a most striking manner of the amoeba. If, as one instance out of many, a drop of blood be drawn by pricking one's finger, and viewed with proper precautions and under a sufficiently high microscopic power, there will be seen, among the innumerable multitude of little circular, discoidal bodies, or corpuscles, which float in it and give it its colour, a comparatively small number of colourless corpuscles, of somewhat larger size and very irregular shape. If the drop of blood be kept at the temperature of the body, these colourless corpuscles will be seen to exhibit a marvellous activity, changing their forms with great rapidity, drawing in and thrusting out prolongations of their substance (*pseudopodia*), and creeping about as if they were independent organisms. The substance which is thus active is a mass of protoplasm, and its activity differs in detail, rather than in principle, from that of the protoplasm of the nettle. Corpuscles of essentially similar structure are to be found in the skin, in the lining of the mouth, and scattered through the whole framework of the body. Nay more, in the earliest condition of the human organism, in that state in which it has but just become distinguishable from the egg in which it arises, it is nothing but an aggregation of such corpuscles, and every organ of the body was once no more than such an aggregation.

Thus a nucleated mass of protoplasm turns out to be what may be termed the structural unit of the human body. As a matter of fact, the body in its earliest state is a mere multiple of such units, and in its perfect condition it is a multiple of such units variously modified. The same may be said too, of everything else, both in the animal and vegetable world. Traced back to its earliest state, the nettle arises, as man does, in a particle of nucleated protoplasm.

We are thus led to the conception of an essential unity in the two great kingdoms of organic nature—a structural unity, in the fact that every living being has protoplasm as the essential matter of every living element of its structure; and a physiological unity, in the universal attribute of irritability, which has its seat in this same protoplasm, and is the prime mover of every phenomenon of life.

Beyond this, however, the biologist cannot at present go. To suppose that *all* protoplasm is identical where no difference cognizable by any means at our disposal can be detected, would be clearly an error. Of three particles of protoplasm, between which we may defy all the power of the microscope and all the resources of the laboratory to detect a difference, one can develop only to a plant (say a nettle), another only to a jelly-fish, and the other only to a man; and one conclusion alone is here possible—that deep within them there must be a fundamental difference which thus determines their inevitable destiny, but of which we know nothing, and can assert nothing, beyond the statement that it must depend on their hidden molecular constitution. And in that molecular condition, so mysteriously infinitesimal as to be beyond all human scrutiny, there is probably as much complexity and difference as there is between the form and arrangement of organs in the most widely separated animals or plants.

The difference between lifeless and living matter is greater still, for the utmost research of science has not yet been able to build up one particle of living matter out of lifeless elements; and the fact remains, that every living creature, from the simplest dweller on the confines of organization up to the highest and most complex organism, has its origin in pre-existing living matter—that the pro-

toplasm of to-day is but the continuation of the protoplasm of other ages, handed down to us through periods of indefinite and indeterminable time.

There are those who would refer consciousness as well as life to a common material source, and find in protoplasm the origin of mind as well as of living matter. But the greatest authorities on this subject agree that, when we say that life is a property of protoplasm, it is as much as we are justified in doing. The utmost efforts of science have not as yet made one step forward towards an explanation of the phenomena of consciousness, or the discovery of its source. It would be absurd to say that there is nothing in the universe but matter and force, but the power of distinctly conceiving of a substance different from matter is still beyond the limits of human intelligence. If in this contingency we decline the aid of faith, there only remains the assumption that man has not already attained the limit of his powers, and the hope that in the far-off future there may yet be evolved within us other and higher faculties from which light may stream out upon the darkness and reveal to man the great mystery of thought.

PROTOPTERUS is a genus of fishes belonging to the group *DIPNOI*, nearly allied to the genus *LEPIDOSIREN*. Only one species is known, *Protopterus annectens*, found in the fresh waters of tropical Africa. This remarkable fish, the *Lepidosiren* of zoological collections, has been brought to this country in a remarkable way. In the dry season, if the water in which it is living dries up, it encases itself in the mud and lives in a torpid condition for many months. These balls of clay are frequently dug up, and the fish may be transported alive within to Europe. The natives also dig them out of the mud for their own benefit, as they esteem the flesh for food.

The *Protopterus* has an eel-shaped body, covered with cycloid scales, and provided with a continuous vertical fin running along the back and round the tail as far as the vent. The pectoral and ventral fins are remarkable. They consist, as in *Ceratodus*, of a jointed cartilaginous axial rod, which, however, in *Protopterus* bears on one side only rudimentary rays supporting a membranous fringe. The notochord is persistent and unconstricted, but the neural arches are bony. The upper jaw is fused with the skull, and bears a strong dental plate like that in the lower jaw, divided into three cutting lobes; there is also a pair of conical teeth on the vomer. There are six branchial arches with five gill-slits, and three small external branchial appendages are also present. The air-bladder is divided into two cellular sacs, so as to act as a lung, and is supplied with venous blood by a true pulmonary artery. In this way the *Protopterus* can breathe air like a reptile. The structure of the heart resembles that of the sharks and ganoid fishes; and the intestine is straight and short, with a spiral valve. The *Protopterus* grows to a length of 6 feet. It feeds on fishes, frogs, and water-insects.

PROTOZOA (Gr. *prōtos*, first; *zōon*, animal) is the name applied to the great assemblage of the lowest forms of animal life. The animal kingdom [see *ANIMAL*] is at once divisible into two sharply defined groups, the *Protozoa* and the *Enterozoa* or *Metazoa*. The *Protozoa* are essentially unicellular animals, that is to say, their whole body consists of a single cell of that substance which Huxley has called "the physical basis of life"—*PROTOPLASM*. Even in those cases where a multicellular character is apparently presented, it is found that the cohesion between the cells is rather mechanical than functional; we find a colony of distinct individuals, not a many-celled unit. All the *Metazoa*, on the other hand, while starting life as a single cell, come, even the simplest of them, to consist of many cells, differing in structure and function among themselves, but combined to form a single individual. In their simplest form they consist of a sac composed of two layers of cells, the innermost of which has nutritive and

the outer protective functions. The polyps and sponges agree with the highest vertebrates in being Metazoa; the animalcules that swarm in a tiny drop of water are examples of Protozoa.

The general characters of the Protozoa are simply those of a single animal cell. [See CELL.] A nucleus, the exact nature of which has not yet been fully determined, but which seems generally to consist of a denser, somewhat specialized mass of protoplasm, is usually discoverable in the cell-body; and its presence has recently been demonstrated in Protozoa, in which it was formerly thought to be wanting. Sometimes several nuclei are present in the same cell; in other cases it seems to be broken up into a number of pieces dispersed through the protoplasm of the cell-body. Vacuoles containing a watery fluid are usually present in the cell. Of these the contractile vacuoles, which may be well seen in an *Amoeba* or *Paramoecium*, seem to play the part of an excretory organ or kidney, separating the waste products and discharging them by bursting at the exterior of the cell. Food-vacuoles are formed by the inception of water together with the solid particles of food on which the animal nourishes itself. Food is taken in either by a definite cell-mouth or at any portion of the cell-surface, and a food-vacuole is formed round it till the process of digestion is complete. A pneumatic vacuole, consisting of a bubble of gas separated by the activity of the protoplasm, is found in a few cases (*Arcella*) with probably a hydrostatic function, serving to keep the animal afloat. In some cases the cell-body is bounded merely by a thin pellicle of a temporary nature, but more usually an envelope is secreted by the protoplasm, which may be of a cuticular character, like the cell-wall of a plant, or may be a shell consisting of chitin, calcium carbonate, or silica. In addition, spines, stalks, &c., are frequently produced on the exterior of the cell, and silicious spicules occur in the protoplasm of the *Heliozoa* and *Radiolaria*. The locomotion of such Protozoa as do not preserve a definite form is produced by the protrusion of *pseudopodia*, lobes or filaments of the cell-body, usually of a temporary nature. In those Protozoa with a definite shape and a cell-mouth there are regular motile organs, vibratile hair-like processes of protoplasm called *cilia*, which create a current in the surrounding fluid, and by washing food-particles into the mouth subserve nutrition as well as locomotion; in other cases there is a single (sometimes several) large process of the same nature, called a *flagellum*, which by its lashing drives the body along in the water.

With regard to reproduction the simplest and most usual method is by transverse fission, the cell dividing into two separate portions, which henceforth lead a distinct life. Often the whole cell breaks up, usually after a period of rest, into a number of spores or minute portions of protoplasm, each of which reproduces the original cell. This process of spore-formation is often preceded by the fusion of two or more individuals into one mass, which then, after passing through a quiescent stage, breaks up. No true process of sexual reproduction is known, though something approaching it occurs in the infusorian *Vorticella*.

The highest class of the Protozoa contains the INFUSORIA, in which the cell has a definite shape, the protoplasm being denser at the periphery than in the centre, and a definite cell-mouth is usually present. Nearly allied to it comes the class Gregarinida, containing the parasitic forms of which the typical genus is GREGARINA. The rest of the Protozoa are usually included in a class, RHIZOPODA, so called from the prevalence of that motion, by means of pseudopodia, which is typically named amoeboid. In this there are several well-marked groups, as the FORAMINIFERA, HELIOZOA, and Radiolaria, which deserve the rank of classes. If these be excluded the Rhizopoda contain the well-known AMOEBA and its allies, and several very low forms, in which no nucleus has yet

been detected, and the protoplasm is quite homogeneous, such as *Protomyxa* and *Vampyrella*.

PROUDHON, PIERRE JOSEPH, a French socialist, born at Besançon in 1809. One of his first publications was his essay, "Qu'est-ce que la Propriété?" to which question he gave the brief and startling reply, "La Propriété c'est le Vol." His easy solution of the problem offended the academy of Besançon, but the economist Blanqui, to whom the book was referred for examination, declared that it contained nothing calling for public censure. In 1843 Proudhon published in Paris his chief work, "De la Création de l'Ordre dans l'Humanité," which was followed in 1846 by his "Système des Contradictions Economiques." His course of philosophical authorship was interrupted by the events of 1848, in which he took a prominent part as editor of the journal *Le Peuple* and as a member of the National Assembly. In the latter capacity he boldly proposed a total liquidation and redistribution by the state of all property then held in France. As this scheme was rejected, he proceeded to carry into practice his theory laid down in the "Solution du Problème Social" (1848), and had made preparations for founding a new society, when he was condemned to three years' imprisonment for publishing seditious articles in *Le Peuple*. He escaped to Switzerland for a time, and then returned to Paris, where he published his book, "De la Justice dans la Révolution et dans l'Eglise" (1858). For this he was again sentenced to imprisonment for three years, and to pay a fine of 4000 francs; but he evaded the sentence by escaping to Belgium, where he remained until his death in 1865.

PROVENCE, an old province of France, including a portion of the territory of the Roman *Provincia*, from which the name is derived, was bounded E. by Italy, N. by Dauphiné, N.W. by the Comtat-Venaissin and the Comtat-d'Avignon, W. by Languedoc, and S. by the Mediterranean. It now forms the department of Bouches-du-Rhône, Var, Basses-Alpes [see ALPES, BASSES], and part of VAUCLUSE. It was divided into Upper and Lower Provence. In Roman times the country was inhabited by various tribes, and formed part of Gallia Narbonensis. About 416 the Romans were dispossessed by the Visigoths and Burgundians, but recovered a tract along the coast from the former in 450. The next invaders were the Franks, who, in 584, under the sons of Clovis, by conquest or cession, obtained possession of the whole territory, which was included also in the empire of Charlemagne. Under his descendants Provence formed part of the kingdom of Arles; it then passed to hereditary counts descended from the counts of Barcelona. Raimond Bérenger V., the last count of Provence, left four daughters, with the youngest of whom, Béatrix, in 1245, the county of Provence passed to Charles of France, count of Anjou. The Angevine family held it till 1481, when Charles, count of Anjou and king of Sicily, made it over to Louis XI. and his successors; and in 1487 it was rennited to the crown by Charles VIII.

PROVERBS. Proverbs are probably the oldest fragments of the wisdom of the early world that have come down to us. Hesiod makes use of several, and Aristotle speaks of them as valuable relics preserved from the general wreck of a former civilization by their point and brevity. Many great men have attached much importance to proverbs, and have made constant use of them; among whom we may mention Aristotle, Plautus, Cicero, Erasmus, Shakespeare, Cervantes, Rabelais, and Montaigne. St. Paul occasionally uses them, as in the well-known instance of "Evil communications corrupt good manners"—which is a fragment from the comic poet Menander; and Jesus himself had recourse to them, as in that universally applicable proverb, "Where the carcase is, there will the eagles be gathered together." In a proverb is concentrated not merely the wisdom of one, but of many. From this cause it derives much of its weight and value, and hence men

readily take refuge from their own single and fallible judgment in the larger experience and wider convictions of which the proverb is the embodiment. The principle of life is singularly vigorous in proverbs. Many of them have come down to us from ancient Egypt and India through Greece and Rome and the middle ages; and, in spite of the variations of languages and the revolutions of nations still flourish in unimpaired vitality. A great many proverbs seem the common inheritance of almost all the nations of Europe, having probably travelled down to them from the Greeks or from the older East. Thus the rabbinical proverb declares that "Alms are the salt of riches;" while the Germans have "Charity gives itself rich, covetousness hoards itself poor;" and the Danes, "Give alms that thy children may not ask them." On self-help we have the Latin, "God helps them that help themselves," and the Basque, "God is a good worker, but he loves to be helped." On truth and falsehood the English have "A lie has no legs;" the Spanish, "A lie has short legs," and that other, "Truth is the daughter of God;" the Swiss, "It takes a good many shovelfuls of earth to bury the truth;" and the French, "Truth, like oil, comes to the surface." On the avenging justice of God there are several good proverbs in various languages. Such are the ancient Greek, "The mill of the gods grinds late, but grinds to powder;" the Latin, "The feet of the (avenging) deities are shod with wool;" and our own, "God comes with leaden feet, but strikes with iron hands." In short, as has been well said—"The proverbs of the street and of the market, true to nature, and lasting only because they are true, are records that the populace at Athens and at Rome were the same people as at Paris and at London, and as they had before been in the city of Jerusalem!"

There is considerable historical interest attaching to the origin of some proverbs. Thus, when some of the officers of Alexander the Great seemed to be struck with consternation at the vast numbers of the Persian hosts that were advancing to assail them, the Macedonian hero reassured them by replying, "One butcher does not fear many sheep"—a saying which afterwards passed into a proverb. When Cæsar at length decided, after much hesitation, to cross the Rubicon and plunge his country into the horrors of civil war, he exclaimed, as he dashed across the stream, "The die is cast!"—a proverbial expression used by gamblers in desperate play. An excellent saying originated with Mohammed. One evening he was about to encamp after a long and weary march through the desert, when he overheard one of his followers saying, "I will loose my camel, and commit it to God." Upon which the prophet instantly replied, "Friend, tie thy camel, and commit it to God."

Proverbs in general are a striking testimony to the feeling of all ages and nations that virtue is not only right in itself, but in general, even in this world, the surest road to happiness and success. There are, it is true, selfish, mean, cowardly, and savage proverbs, which the base, the revengeful, and the narrow-minded may quote to excuse their conduct. But these are the exceptions. They are but as scattered weeds in a fine field of corn. The vast majority of proverbs are in favour of honesty, truth, manliness, generosity, industry, piety. In the main they range themselves under the banners of the right; and far more are the children of light and the day than of darkness and the night. The comparative scarcity of unworthy proverbs is, indeed, one of the most noticeable facts in their history.

Among the more celebrated collections of proverbs we may note that made by Polydore Virgil from Greek and Latin sources (Ven., 1498), and the "Adagia" of Erasmus (Par., 1508), containing 5000 proverbs, gradually collected from a diligent study of the classical writers. Latin collections of classical proverbs are those of Leutsch an-

ichneidewin (two vols., Gott., 1839-51), and Kruse (1868). There have been several collections of Spanish proverbs, some of which can be traced back to the reign of Alphonso VI., who died in the beginning of the twelfth century, when the language of Castile had scarcely a distinct existence, the most complete being that of Juan de Yriarte, the royal librarian, issued at Madrid about the middle of the eighteenth century, and which contains no fewer than 24,000. French proverbs have been collected by De Linzy (2nd ed., two vols., Par., 1859) and Cahier (Par., 1856); German by Wander in a learned and exhaustive work (five vols., Leips., 1863-77); Finnish by Lönnrot (Hels., 1842); Dutch by Harrebomée (three vols., Utr., 1858-65); and Arabic by Freytag (three vols., Bonn, 1838-43). There are several collections of English proverbs, and Camden, Herbert, Howell, Fuller, Ray, and many others have done much to preserve the proverbial wisdom of the nation. Among the later works of this description are those of Bolin (Lond., 1855), and Hazlitt (Lond., 1869). A collection of Scottish proverbs was published by A. Hislop (Edin., 1870), and Kelly's collection of "Proverbs of all Nations" reached a third edition in 1870 (London).

We cannot better close our notice of this subject than by quoting the eloquent sentences with which D'Israeli winds up his learned and instructive article on the "Philosophy of Proverbs." "Proverbs," he says, "embrace the wide sphere of human existence; they take all the colours of life; they are often exquisite strokes of genius; they delight by their airy sarcasm or their caustic satire, the luxuriance of their humour, the playfulness of their turn, and even by the elegance of their imagery and the tenderness of their sentiment. They give a deep insight into domestic life, and open for us the heart of man, in all the various states which he may occupy. A frequent review of proverbs should enter into our readings; and although they are no longer the ornaments of conversation, they have not ceased to be the treasures of thought."

PROVERBS, BOOK OF. one of the canonical books of the Old Testament bearing the Hebrew title, derived from the opening words of *Mishlé Shelômoû*, "the Proverbs of Solomon." The Septuagint title is a literal rendering of the foregoing, and the book is commonly referred to in the Talmud under this name, though in the early centuries of Christianity it was frequently termed the Book of Wisdom, both by Jews and Christians. Among the Jews the authority of the book was at one period the subject of some discussion, and it appears that the followers of Shammai placed it among the apocryphal writings, but it occurs in all the Jewish lists of the sacred books, and it has always been accepted by the Christian church.

In its present shape the book is made up of a number of distinct parts, evidently composed or collected at different periods; but much difference of opinion exists among modern scholars as to which are the exact divisions of the book, and also as to the date and authorship of the various sections. Leaving minor questions aside, however, the principal divisions of the book may be indicated as follows:—

(1.) Chap. i. 1-7, the general heading or superscription of the book, ascribing it to Solomon and indicating the design of its composition.

(2.) Chap. i. 8 to chap. ix. 18, a long and beautiful passage in praise of wisdom, in which the benefits she confers are pointed out, the evils which follow disobedience to her counsels are indicated, and in which men are exhorted to devote themselves to her. A remarkable feature of this section is the personification of wisdom in chap. viii., which formed the foundation for the Jewish doctrine of wisdom afterwards developed in the apocryphal "Wisdom of Solomon," "Ecclesiasticus," and elsewhere. The position

assumed by the author of this section is that of one of the wise addressing a youthful pupil as "my son."

(3.) Then follows the largest of the divisions of the compilation, extending from chap. x. 1 to xxii. 16, and which has a special title, "the Proverbs of Solomon." It consists of a collection of about 870 short proverbs and detached sentences, most of which are examples of antithetic parallelism, the second clause containing the contrast to the first. These proverbs are of a very miscellaneous character, comprising precepts of religion, observations upon life, and maxims of secular prudence, and they do not appear to have been classified or arranged with any regard to sequence in teaching or subject matter.

(4.) Chap. xxii. 17 introduces us to two short sections which have been put together by an editor, the first extending to chap. xxiv. 22, and the second to chap. xxiv. 23-34. The first of these sections is introduced by the appeal, "Incline thine ear and hear the words of the wise," and the second bears the connecting line, "These also are sayings of the wise."

(5.) Then follows another large and important collection, chap. xxv.-xxix., which, according to the superscription, professes to be a collection of the proverbs of Solomon, "which the men of Hezekiah, king of Judah, copied out." The meaning of the latter phrase appears to be "compiled," and the idea conveyed is that of the transfer of matter from small collections and various sources into one single authorized work, issued under the patronage of the king. It was evidently prepared by men who were unacquainted with section 3 as we have it, for many proverbs appear in both collections, either as exact repetitions or with merely verbal alterations.

(6.) The concluding portion of the book consists of three appendices—chap. xxx., entitled "The words of Agur the son of Jakoh of Massu;" chap. xxxi. 1-9, entitled "The words of King Lemuel;" and chap. xxxi. 10-31, consisting of an alphabetical acrostic in praise of a virtuous woman.

With respect to the date of the composition of the different sections the materials for forming an opinion are very scanty, and the conclusions of the most eminent of modern critics are uncertain and contradictory. It is established beyond all question that much of the book dates from a period much later than that of Solomon, but on the other hand the tradition which associates his name with it cannot be wholly set aside. Renowned as he was for wisdom it is extremely probable that collections would be made of his sayings, to which other maxims which obtained currency would from time to time be added, the whole being called after his name; and in this way the materials would be formed for the compilation of sections 3 and 5. The other divisions must be placed at later periods of Jewish history, probably not earlier than the last years of the monarchy or the post-exile period.

The translators of the Septuagint version appear to have had before them a different version of the book from that which has come down to us, their translation showing a different arrangement of materials, many varieties of reading, numerous additions, and still more numerous and remarkable omissions from the Massoretic text.

PROVIDENCE, a city and seaport of the United States, and one of the capitals and the most important trading and manufacturing centres of Rhode Island, is situated on elevated ground in a fine position on both sides of Providence River, where it falls into Narragansett Bay, 178 miles north-east of New York by rail, and about 80 from the Atlantic. The navigation is rarely impeded by ice. The town has many fine residences and public buildings and institutions, among which are several places of worship, including a Baptist church, built in 1680 by Roger Williams, to whom the first settlement is ascribed, together

with the honour of establishing the first political community in America in which perfect religious equality was admitted. There are also numerous schools, educational institutions, Brown University, Athenæum, several hospitals, a fine exchange, and a state house. The principal trade and manufacture is in cloth, iron, chemicals, dye stuffs, coal, and jewelry. The population in 1880 was 104,580.

PROVINCE, in its modern acceptance, is an important division of a kingdom or state, comprising several cities, towns, &c., under the same ecclesiastical or civil jurisdiction, as, in England, the provinces of the archbishoprics of Canterbury and York.

PROVISIONAL ORDER. When the head of any government department orders a thing to be done which could not otherwise be accomplished except by an Act of Parliament, it is called a Provisional Order. It does not receive effect until it has received the sanction of Parliament, and even afterwards it still retains the title of a provisional order.

PROVISIONS OF OXFORD, a sort of mediæval Reform Bill, made necessary by the bad government of Henry III. They were the outcome of the Parliament of Oxford in 1258, when the barons presented a protest against the royal exactions of money and a long list of other grievances, because of the systematic evasion of the safeguards of MAGNA CARTA, which had been many times confirmed, and even so lately as 1253. The barons had previously, in 1234 and 1237, made firm attempts to remodel the government; now, in 1258, they produced a definite plan of reform, to be carried out by a committee of twenty-four members, twelve nominated by the king and twelve by the barons. Subsequently ecclesiastical reform was added to the charge laid upon this committee. Fifteen counsellors were ordered by the committee to act as the permanent advisers of the crown; the barons' twelve selecting two of the king's twelve (the Earl of Warwick and John Mansel), and the king's twelve selecting two of the barons' twelve (Roger the Earl Marshal and Hugh Bigod), and these four adding eleven others to themselves by co-optation. Two other committees were appointed, one of twelve members nominated by the barons to consult with the king's council, and one of twenty-four members to consider financial matters and especially the royal taxes. Other provisions were that the chancellor was to seal nothing save by the sole will of the king, the salaries of the judges were to be raised to prevent their taking bribes, MAGNA CARTA to be strictly adhered to in future, three meetings of Parliament to be held annually, &c.

PROVISIONS OF WESTMINSTER.—But the shifty king managed to circumvent the Provisions of Oxford, consequently the next year the Provisions of Westminster (1259) were added; and these were reissued in stronger and stronger form in 1262 and 1264. They chiefly related to details of the feudal tenures, exempting knights from juries, checking abuses of feudal aids, forbidding the then common trick of giving up estates to the church to receive them back as caretakers, thereby (since they were nominally church lands) avoiding the obligation of military service, &c. In 1264 the divisions between Henry and his barons had grown to such a pitch that the French king (*St. Louis*, Louis IX.) was requested to adjudicate, and at the *Mise of Amiens* he pronounced in favour of the king. The *dictum de Kenilworth* (1266) was issued after the defeat of the barons at Eversham, reasserting the king's prerogative and annulling the Provisions of Oxford; but in 1267 the Provisions of Westminster were thrown into the old-fashioned form, and issued afresh as the Statute of Marlborough. The method of procedure by provisions was not afterwards continued.

PROVISORS, STATUTES OF. The first Statute of Provisors, that is, the forbidding of papal provisions

(nominations to a benefice as yet unvacated), was passed in 1351 under Edward III.; and the term was afterwards used for any measure resisting papal patronage. This statute was supplemented by the more general one of *Præmunire* two years later, asserting the supremacy of the king's courts. The second Statute of Provisors was much more stringent than the first, and was passed in Richard II.'s reign in 1390, followed by the great Statute of *Præmunire* (1393). It was one of the complaints against Richard that he frequently "suspended" the Statute of Provisors. [See *SUSPENDING POWER*.] The curious right to record protests possessed by the minority in the House of Lords when outvoted was frequently exercised during the fourteenth century by the spiritual peers (then very numerous, including all abbots and many priors) against both Provisors and *Præmunire*.

PROVOST is the name given to the heads of certain colleges, as Eton, King's College (Cambridge), &c. In Scotland it is used to designate the chief officer in cities, as the lords provost of Edinburgh and Glasgow, where in England the same officer is called the mayor.

PROVOST-MARSHAL, a term adopted from the French. The English provost-marshal is attached to the army, his duty being to attend to offences committed against military discipline, to seize and secure deserters and other criminals, to restrain the soldiery from pilfering and rapine, to take measures for bringing offenders to punishment, and to see to the execution of the sentences passed upon them.

PROXY, the agency of another who acts as a substitute for his principal. In parliamentary law every peer could formerly constitute another lord of Parliament of the same order with himself his proxy to vote for him in his absence; but in 1868 a new "standing order" was adopted by which it was agreed "That the practice of calling for proxies on a division shall be discontinued."

PRUD'HOMMES (*Prudentes Homines*, experienced men). In 1452 King René established at Marseilles a council of prud'hommes, with summary jurisdiction in disputes between the fishermen of that port; this institution has since been frequently confirmed, and still exists. In 1464 Louis XI. granted power to the citizens of Lyons to appoint a prud'homme to decide summarily upon disputes that might arise between merchants attending the fair. By a decree of Napoleon, dated 18th March, 1806, a council of prud'hommes, consisting of nine members (five manufacturers and four master weavers), elected annually, was established in Lyons to settle disputes between manufacturers and their workmen and between masters and apprentices. The council acted chiefly as a court of conciliation, but was also vested with power to decide, without appeal or expense, cases involving an amount not exceeding sixty francs. This institution has been recognized and confirmed by succeeding governments. Councils of prud'hommes with increased numbers, with powers of summons, seizure, and imprisonment not exceeding three days, and with summary jurisdiction to the amount of 100 francs, are now established in all the great manufacturing towns of France. If the amount disputed exceeds 100 francs, an appeal lies to the Tribunal of Commerce. The sittings of these councils are held in the evening, when the workmen have given over their labour for the day. Lawyers are not suffered to plead in their courts. The council of prud'hommes is one of the most useful institutions in France; in Lyons alone the cases decided annually exceed 5000; appeals are rare, and a reversal of the decree of the council very much rarer still.

PRUDHON, PIERRE PAUL, a distinguished French minister, was born at Clugny in Bourgogne, 6th April, 1760. He went as royal pensioner to Rome, where he studied hard and formed a close friendship with Canova. Returning to France in 1789 he was for years constrained

to paint portraits in miniature, &c. His great work was painted in 1808, an allegory of "Justice and Vengeance pursuing Crime," which at once made him famous. It is now in the Louvre. Prudhon's manner was very different from that of David, at that time the supreme ruler in French art, and no doubt hastened the reaction from the frigid classicism of his rival. Prudhon's style was soft and graceful, rather than severe. He died on 16th February, 1822.

PRUNELLA is a genus of plants belonging to the order LABIATAE, distinguished by its two-lipped calyx, the upper lip having three truncate teeth, and the lower being bifid. The species are common in temperate parts of both hemispheres. *Prunella vulgaris* (self-heal) is common in damp pastures in Great Britain, and also in Europe, Central Asia, North America, and Australia. It grows to a height of about 8 inches, and has stalked oblong-ovate leaves and purplish-blue or white flowers collected into a dense spike. This plant is slightly astringent, and was highly esteemed by the old herbalists, but has completely fallen into disuse. *Prunella grandiflora* is native throughout Europe in woods and shady places; the flowers are of a purple or violet colour, seldom white. All the species of *Prunella* are showy when in blossom, and are therefore worth cultivation in flower gardens and rock work.

PRUNES are the dried fruits of certain species of *PLUM*.

PRUNUS. See *PLUM* and *APRICOT*.

PRURIGO is a form of skin disease characterized by a thickening and discolouration of the integument, the appearance of small clear blebs or pimples, the heads of which are generally encrusted with dried blood caused by the scratching of the patient, and which is attended with itching of an intense character. In some forms of the disease the itching is incessant, and it has a pricking burning character, which has caused it to be compared to the biting of a swarm of ants. Pruritis may occur as a general affection of the skin, but it is also met with as a local disease, the parts round the anus (*prurigo ani*) and the folds of the clitoris (*prurigo clitoridis*) being especially liable to its attack, the symptoms of the latter form of the affection being remarkable for their intense severity. Although the malady is not limited to any period of life, it is most prevalent among old people, and one variety of it is accordingly characterized as *prurigo senilis*. This form of the disease is generally marked by considerable disorganization of the skin, much nervous irritation, an aggravation of the symptoms when the patient approaches the fire or gets warm in bed, and too often it proves very obstinate and hard to remove, often lasting for years.

Arising from a feeble state of nerve function, which brings about an impaired nutrition of the skin, together with an irritability of nerve structures, the treatment of this disease must be constitutional as well as local. Great attention must be paid to diet, plenty of nourishing wholesome food being required, though stimulating beverages should be avoided. The bowels must be kept regular by suitable measures, and strengthening and tonic medicines, such as cod-liver oil, quinia, strychnia, phosphorus, and arsenic, should be administered. Local treatment consists in the use of the Turkish bath, including shampooing, the use of ordinary baths—hot, cold, or sea, according to the special requirements of the case—the application of bland unguents, and sponging with hot water or hot decoction of poppy-heads. Among medical applications lotions of tar and almond emulsion, with Lornax and hydrocyanic acid, have the best reputation.

PRUSSIA, a large and important kingdom in Central Europe, and the head of the German Empire. Until 1866 it consisted of two great divisions, entirely unconnected with each other, the distance between them at the nearest point being more than 30 miles. But as one of the chief

results of the war with Austria in 1866 was the incorporation of Hanover and other states of less importance, the kingdom now forms a compact country. It is bounded on the W. by France, Belgium, and Holland; on the N. by the North Sea, Denmark, and the Baltic; on the E. by Russia and Poland; and on the S. by Bohemia and other parts of Austria, Saxony, and some other German states.

Surface, Soil, Rivers, &c.—Rhenish Prussia is divided into two equal portions by the Rhine, and each of these divisions consists of an elevated table-land and a low plain. The larger part of the table-land lies to the north of the River Moselle, and is called the Eifel, and in its northern districts the Hohe Veen. Much of this table-land exhibits traces of volcanic agency. The soil is in most places poor.

The level country which extends from the northern border of the Eifel and Hohe Veen, between the Rhine and the Maas, is nearly a flat, which sinks imperceptibly as we proceed northward. Its fertility is considerable, and it produces rich crops of all kinds of grain.

Opposite the table-land of the Eifel, on the right bank of the Rhine, is a similar plateau, which extends southward through Nussau, where it rises along the banks of the Maine and Rhine to a more elevated ridge, known under the name of Taunus. From the Taunus the table-land extends northward, and terminates on the northern bank of the River Ruhr, an affluent of the Rhine. The soil is very poor, but iron and coal are found in abundance; and these have given rise to considerable manufacturing industry.

The Rhine separates the two table-lands just mentioned, and runs in a narrow valley, frequently through deep gorges noted for their picturesque beauties.

The eastern and larger portion of Prussia is a part of the Great Plain of Eastern Europe. On the boundary of Prussia and BOHEMIA is that mountain range which bears the general name of the Sudetes, and whose northern portion is called Riesengebirge, or Giant Mountains. There are mountains also on the line which separates Prussia from Saxony, comprehending a part of the two systems of the Thüringerwald, or Mountains of Thuringia, and of the Harz. The highest summit of the Sudetes is Schneekoppe, or Riesenkoppe, which is 5291 feet high; of the Thüringerwald, the Great Beerberg, 3258 feet; and of the Harz, the Brocken, 3729 feet.

The Great Plain is not a dead level, the surface being diversified by several moderate elevations. Two of these traverse this portion of Prussia from east to west in its whole extent. From the northern heights the country slopes to the shores of the Baltic with an undulating surface, which is seldom varied by a hill. To the south-east of the higher portion of the elevation extends the Tuchler Heide (Heath of Tuchel), which is the most barren region in Prussia. It is covered with sand and stunted shrubs, and is 50 miles in length, and from 20 to 25 in width. On the northern side the country is of moderate fertility, but it improves as it approaches the shores of the Baltic. The southern elevation is connected at its eastern extremity with the mountains of Sandomir, in Poland, and with those surrounding the mining town of Olkusz, north-east of Cracow. It extends westward to the Elbe, near Magdeburg, and rises at its highest point to an elevation of about 1000 feet. The country which lies between the two elevations, west of the meridian of 19 degrees, is not distinguished by fertility, except in some of the river bottoms; the other parts are rather more productive. The south of this district is more favoured by nature than the other parts of the Prussian kingdom. Completely sterile tracts are rare and of small extent; the country about the town of Magdeburg is noted for its fertility, and is considered the granary of Berlin. The capital itself is situated in an extensive sandy plain, interspersed with fertile tracts, and covered in some places with pine forests.

The climate is humid along the Baltic, and very cold generally in the northern parts, particularly in Posen, where the severity of the temperature is caused by the elevation of the country. In the south of the kingdom the weather is generally temperate and salubrious; and the prevailing winds are from the west.

In Rhenish Prussia the chief river is the RHINE, which runs through this division of the monarchy from south to north, and is navigable for large vessels as far as it flows through the Prussian dominions. Several rivers join it from the east and west, among which are the Sieg, Wipper, Ruhr, Lippe, and Moselle. The Ems also traverses this part of the kingdom, and, after a course of 160 miles, falls into the North Sea.

In the eastern provinces of Prussia four large rivers—the Elbe, Oder, Vistula, and the Niemen—drain the elevations which run through the country. The ELBE, NIEMEN, and VISTULA are described separately. The Oder rises in Moravia, in the Sudetes Mountains, flows through Silesia, passes by Breslau, where it becomes navigable for barges, enters Brandenburg, and flowing thence through Pomerania, falls into the Baltic in Swinemünde Bay. It is 455 miles long, and is of great commercial importance. Between the two elevations, however, the affluents of these rivers run east and west; and as many of them are navigable for river boats, owing to the slowness of the current, they facilitate the intercourse between the countries on their banks. The minor rivers are the Saale, Unstrut, Elster, Havel, and Spree, affluents of the Elbe; the Klodnitz, Bartsch, Warta, Netze, Bober, Neisse, Finow, Ucker, and Peene, which fall into the Oder; the Brahe, a tributary of the Vistula; the Yura and Seltschuppe, which flow into the Niemen; and the Persante, Elbinge, Pregel, Deime, and Dange, which fall into the Baltic.

Through the sluggishness of the rivers they often overflow their banks, and thus form the lakes and bogs which are so numerous, especially in the level provinces of the east. These lakes are in general small and uninteresting; the largest are Lakes Spirding (which has an area of 20 square miles) and Mauer (nearly the same size), the waters of both of which are discharged by the River Pregel. The rivers are connected by many canals; in this way the Oder is joined to the Vistula, the Spree, the Elbe, and the Havel. The islands belonging to Prussia are those of Rugen (of very irregular shape), Usedom, and Wollin, all in the Baltic. The coast-line of the Baltic, which is 520 miles in length, has few good harbours. It is flat, and covered with extensive lagoons, the principal of which are the Kurische Hafl, at the mouth of the Niemen; the Frische Hafl, at the mouths of the Vistula and Pregel; and the Stettiner Hafl, at the mouth of the Oder.

Hafl means bay. Kurische Hafl is the Bay of the Cures, the people who lived on its shores; Frische Hafl is so called from the "freshness" of the water; Stettiner Hafl means the Bay of Stettin, and is named after that town. The tongues of land which inclose the hafls are called *Nehrung* (low land). These hafls are of fresh water, and are on that account, and because they are almost landlocked, classed by some geographers among the lakes. They are extremely shallow, and encumbered with sandbanks, which renders them of comparatively little use in navigation. The Kurische Hafl is also subject to hurricanes.

Productions, Manufactures, and Commerce.—Prussia does not possess a great variety of natural productions, but it has all those the cultivation of which has been gradually introduced into Central Europe, and the most indispensable of them in sufficient abundance for its own consumption, and for the obtaining of foreign luxuries and comforts. Pasturage is generally excellent; and sheep, cattle, and horses of improved breeds are extensively reared. The

swine are principally bred in Pomerania, Saxony, and Westphalia, the last being celebrated for its hams; and the goats in the mountain districts of Silesia and Saxony. Wild geese are extremely numerous, especially in Pomerania. Of wild four-footed animals, there are, fit for food—stags, fallow-deer, wild boars, hares, and rabbits. Beasts of prey and fur-bearing animals include wolves, foxes in abundance, bears (rarely met with), lynxes, beavers, badgers, pole-cats, otters, weasels, and martens; the ermine is very rare. Domestic poultry of all kinds are plentiful. Of birds of prey, there are the eagle, the sparrow-hawk, the kite, and some others. Fish are extremely abundant in the rivers and lakes, as well as on the long line of coast on the Baltic. Bees and silkworms are extensively reared.

Agriculture is the chief source of the national wealth, and is carried on with such great care and unwearied industry that crops are raised from an often naturally poor soil, not only sufficient for the wants of the population, but also to leave an important surplus for export. Wheat, rye, oats, and barley are raised both for home consumption and exportation; there are also crops of pease, beans, vetches, millet, maize, rapeseed, and linseed. Potatoes are cultivated in all the provinces. Flax, hemp, hops, tobacco, succory, beet-root, and garden vegetables of all kinds are raised. The vineyards of Rhenish Prussia are extensive and valuable, very superior wine being obtained from the banks of the Moselle and the Rhine. The vine is also cultivated to a small extent in detached districts of Central and Eastern Prussia. The production of fruit has been widely extended. The forests furnish abundance of excellent timber. The minerals are rather abundant for so flat a country. They comprise salt from salt-springs, of excellent quality and in great abundance; amber and coals in large quantities; alum, vitriol, saltpetre, alabaster, basalt, granite, porphyry, marble, slate, freestone, chalk, lime, porcelain-clay, pipe-clay, &c. The precious stones found are the onyx, agate, jasper, and cornelian. The metallic products are silver, copper, tin, lead, iron, zinc, cobalt, arsenic, and calamine. Mining industry is on the increase. The mines are mostly in the provinces of Rhenish Prussia and Westphalia, and in the Harz Mountains. The coal-mines produce about 50,000,000 tons per annum. Iron is widely diffused, and of excellent quality; amber is obtained almost exclusively in Prussia, and is a government monopoly.

The manufactures of Prussia are very extensive, and increasing in value. The principal articles made are:—Linen in all the provinces, but chiefly in Silesia; woollen cloths and cotton goods, especially in the province of the Rhine, at Elberfeld, Barmen, Crefeld, &c.; silk, leather, iron, steel, and copper ware, cutlery, articles of gold and silver, succory, paper, china, glass, earthenware, saddlery, carriages, chemical products, snuff and tobacco, beet-root sugar, gunpowder, &c. The breweries and brandy distilleries are very considerable. The weaving of linen and woollen goods for home use is very general, the loom being found in many cottages.

The abundance of products of various kinds, and the active industry of the people, give rise to an extensive commerce, which is highly favoured by the advantageous position of the kingdom, in the centre of Europe, the great extent of coast on the Baltic, and by the great rivers (the Rhine, the Elbe, the Oder, and the Vistula) which traverse the country, and are connected by navigable tributary streams and numerous canals. Trade has been greatly developed by the excellent roads, canals, and railways, and still more by the establishment of the Zollverein or Commercial Customs Union. The first step towards its establishment was taken in the year 1828, when, by special treaties, the grand-duchy of Hesse and the duchy of Anhalt were brought within the customs limits of Prussia. Previous to this date the various states of Germany were under complete commercial separation, each having its own tariff

of import and export duties, its own line of custom-houses, and in most cases its own system of money, weights, and measures; but the efforts of the Prussian government caused the gradual overthrow of these barriers to mutual intercourse, by the extension of the bond of union inaugurated in the treaties with Hesse and Anhalt. In 1829 the two Saxon duchies of Meiningen and Coburg-Gotha were induced to join the Zollverein, and four years after, in 1833, its boundaries were vastly enlarged by the entrance into it of the kingdoms of Bavaria, Württemberg, and Saxony. The circle was completed within the next thirty years, during which all the states of Germany, with the exception of the two duchies of Mecklenburg, and the three free cities of Hamburg, Lübeck, and Bremen, were brought into the great commercial union. The two Mecklenburg duchies, together with Lübeck, acceded to it on 1st September, 1848. The administration of the Zollverein is carried on by delegates of the various states composing it, with a central government at Berlin.

The principal Prussian ports are Memel, Pillau, Königsberg, Dantzic, Colberg, Swinemünde, Stettin, Wolgast, Stralsund, Kiel, and Flensburg on the Baltic, and Altona, Harburg, Geestmünde, Leer, and Emden on the North Sea.

There are about 15,000 miles of railway open, a large proportion of which is single line. The large main lines belong to the state, and the whole will ultimately become national property. About half the public debt was incurred to assist in railway construction.

The total length of river navigation in Prussia exceeds 3500 miles, and there are nearly 500 miles of canals. Connected with the railways or canals are lines of telegraph extending to the chief points on the frontier; and the postal arrangements are excellent and complete.

Constitution and Government.—Until 1848 the constitution of Prussia was an unlimited monarchy, but in consequence of the revolutionary movements in that year the king was compelled to convoke a national representative assembly. The royal decree authorizing that proceeding has since been repeatedly modified, but the fundamental laws now vest the executive and part of the legislative authority in a king of the house of Hohenzollern, who attains his majority upon accomplishing his eighteenth year. The crown is hereditary in the male line only, according to the rights of primogeniture. In the exercise of the government the king is assisted by an irresponsible *Staatsrath* or privy council, revived in 1884, and a cabinet of ministers, nominally responsible to the chambers. The legislative authority the king shares with a representative assembly, composed of two chambers, the first called the *Herrenhaus* or House of Lords, and the second the *Abgeordnetenhaus* or Chamber of Deputies. The assent of the king and both chambers is requisite for all laws. Financial projects and estimates must first be submitted to the second chamber, and be either accepted or rejected *en bloc* by the Upper House. The right of proposing laws is vested in the king and in both chambers. The House of Lords is composed of the princes of the royal family who are of age; the chiefs of the mediatised princely houses, recognized by the Congress of Vienna, to the number of sixteen, in Prussia; the heads of the territorial nobility formed by the king (some fifty members); a number of life peers, chosen by the king among the class of rich landowners, great manufacturers, and national celebrities; eight titled noblemen elected in the eight provinces of Prussia by the resident landowners of all degrees; the representatives of the universities, the heads of chapters, and the burgomasters of towns with above 50,000 inhabitants; and an unlimited number of members nominated by the king for life, or for a more or less limited period.

The second chamber consists of 432 members. Every Prussian who has attained his twenty-fifth year, and is qualified to vote for the municipal elections, is eligible to

vote as an indirect elector, but only for his own parish, although he may have municipal qualifications in others. These indirect electors select the direct ones, in the proportion of one for every 250 of the population; and it is by the direct electors that the deputies are chosen. The legislative period of the second chamber is limited to three years. Every Prussian is eligible to be a member who has accomplished his thirtieth year, who has not forfeited the enjoyment of full civic rights through judicial sentence, and who has paid taxes to the state for three years. The chamber must be re-elected within six months of the expiration of the legislative period, or after being dissolved. Both chambers must meet annually, and they are to be convoked, opened, adjourned, and prorogued simultaneously. They regulate their order of business and discipline, and elect their own presidents, vice-presidents, and secretaries. The sittings of both chambers are public; but at the proposition of the president, or of ten members, each may proceed to secret deliberation. Neither house can adopt a resolution when the legal majority of its members is not present. Both chambers can refer documents addressed to them to the ministers, and demand explanations relative to complaints contained therein; and they have also the right to appoint commissions of investigation of facts for their own information. The members of both chambers are held to be representatives of the whole population. They vote according to their free conviction, and are not bound by prescriptions or instructions. They cannot be called to account, either for their votes, or for opinions uttered by them in the house. No member of the chambers can, without its assent, be submitted to examination or arrest for any proceeding entailing penalties, unless seized in the act, or within twenty-four hours of the same. Similar proceedings are necessary in case of arrest for debt. All criminal proceedings against members, and all examination or civil arrest, must be suspended during the session, should the house whom it may concern so demand. Members of the second chamber receive travelling expenses and diet money from the state, according to a scale fixed by law, amounting to 20 marks, or £1 sterling per day. Refusal of the same is not allowed.

Each province of the kingdom is placed under the superintendence of an "Ober-präsident," or governor, and has also a military commandant, a superior court of justice, a director of taxes, and a consistory, all appointed by the king. The consistory is divided into three sections—one having the superintendence of schools, another of ecclesiastical affairs, and another of the public health. The provinces are subdivided into regencies or counties, and these again into *kreise* or circles, and the latter into *gemeinden* or parishes. Each regency has a president and an administrative board or council, and the further subdivisions have also their local authorities. The principal functionaries are all elective, but the elections must be confirmed by the king or the authorities. The system of law principally in force in the eastern states of the Prussian monarchy is embodied in a well-digested code entitled "*Landrecht für die Preussischen Staaten*," which received the royal sanction in 1791, and became law in 1794; but it is occasionally modified by custom, and Polish, Swedish, and German laws are still in force in certain parts of the monarchy. The Rhenish provinces follow, with some exceptions, the rules laid down in the Code Napoléon. The primary proceedings in judicial matters take place before local courts established in the circles and towns; thence they may be carried before the provincial courts, or "*oberlandes gerichte*," and in the last resort before the supreme tribunals at Berlin. The judges are independent of the government. Trial by jury exists in all parts of the kingdom. Until 1849 it was confined to the Rhine provinces. All exclusive privileges arising from titles or station were abrogated by the constitution of 1850, and

perfect equality in the eye of the law is now fully recognized. The same decree also acknowledged the right to hold meetings, unarmed, within closed doors, and become members of societies. It also guaranteed the inhabitants immunity from domiciliary visits, and the inviolability of their letters.

Area and Population.—The area of Prussia extends over 6315 geographical or 137,066 English square miles, and the population is 27,279,111. The kingdom is administratively divided into twelve provinces, which are again subdivided into thirty-five government districts, with the principality of Hohenzollern, the cradle of the royal family.

The following table gives the area and population, according to the census of 1st December, 1880:—

Provinces.	Area, English sq. miles.	Population.
East Prussia (Ostpreussen), . .	14,729	1,933,936
West Prussia (Westpreussen), .	10,151	1,405,898
Brandenburg,	15,505	3,389,155
Pomerania (Pommern),	12,130	1,540,034
Posen,	11,330	1,703,397
Silesia (Schlesien),	15,666	4,007,925
Saxony (Sachsen),	9,729	2,312,007
Schleswig-Holstein,	8,524	1,127,149
Hanover (Hannover),	14,846	2,120,168
Westphalia (Westfalen),	7,771	2,043,442
Hesse-Nassau,	5,943	1,554,376
Rhine (Rheinland),	10,289	4,074,000
Principality of Hohenzollern, . .	453	67,624
Total,	137,066	27,279,111

Church and Education.—The royal family belong to the Reformed or Calvinist faith; but all denominations of Christians enjoy the same privileges, and are equally eligible to places of trust or emolument. The Protestant religion, in its two branches of Lutheran and Calvinist, preponderates, and is professed by 64·64 per cent. of the Prussian people. To the Roman Catholic Church belong 33·74 per cent.

The Protestant Church is governed by consistories, or boards appointed by government, one for each province. There are also synods in most circles and districts. The constitution of the Catholic Church differs in the various provinces; but the crown has reserved to itself a control over the election of bishops and priests, except in the Rhenish territories, where they are under the direct control of the Pope, according to a special agreement. The incomes of the clergy differ greatly, but are generally very small. The higher Catholic dignitaries are paid by the state, the Archbishop of Breslau receiving £1700 a year, and the other bishops about £1135. The incomes of the parochial clergy, of both sects, mostly arise from endowments. In general the government does not guarantee the stipend either of Protestant or Catholic clergymen; but in some parishes the clergy enjoy a public provision from the state. This is peculiarly the case in the Rhenish provinces, in virtue of a concordat with Rome.

The system of public education in force in Prussia is held to be a more perfect one than any other on the continent of Europe. The main feature of it is that attendance at school is enforced by law. Every child, whether male or female, rich or poor, must attend a school from the age of five years till such time as the proper authority affirms that the child has acquired all the education prescribed by law for an individual in its station; generally speaking, the school time extends to fourteen years of age. Should a child not attend, its parents or

guardians must satisfy the public authorities that it is receiving an appropriate education at home or in a private seminary. The school fees are exceedingly moderate; and the children of poor persons, who are unable to pay them, are instructed gratuitously at the public expense. All private and public establishments for education are placed under the superintendence of authorities appointed by the state, and all public teachers have the rights and obligations of servants of the state. "Pupil teachers," as understood in England, are not known. The management of elementary schools belongs to the parishes; but the state appoints teachers from a list of qualified persons, with the concurrence of the parishes. The salaries of the teachers are paid partly by the state and partly by the local authorities.

The ten universities of the kingdom—Berlin, Bonn, Breslau, Göttingen, Greifswalde, Halle, Kiel, Königsberg, Münster (till lately a Roman Catholic high school), and Marburg—have about 7000 matriculated students. The universities are placed directly under the control of the minister of public instruction, and considerable sums are applied to their support. The largest library in the kingdom is the Royal Library, in Berlin, which contains upwards of 500,000 volumes. There are several artistic, literary, and scientific societies in the large towns.

Revenue and Expenditure.—The annual revenue of Prussia is about £60,000,000. The expenditure is generally less, and the surplus is devoted to public works, &c. The national debt was £195,000,000 in 1886. Railways are now the largest single item of state revenue, yielding nearly £34,000,000 annually.

Army and Navy.—The situation of Prussia, surrounded by powerful states, requires a large military force. But as the revenue is comparatively limited, it became indispensable to endeavour to organize the army so that it might embrace the maximum of force with the minimum of expense. The government seems to have satisfactorily solved this difficult and important problem, by basing the military organization of the country, since the year 1814, on the principle that every man capable of bearing arms shall receive military instruction, and enter the army for a certain number of years. There are, practically, very numerous exceptions from service, though no substitution whatever is officially allowed. The regular standing army is composed of those who have voluntarily enlisted, and that portion of the youth of the nation who are at the time fulfilling their compulsory period of service.—for every Prussian subject is enrolled as a soldier as soon as he has completed his twentieth year. He has to be in service during seven years, of which period three years must be passed in the regular army, and the rest among the troops of the reserve. At the end of this term, the soldier enters the *Landwehr* ("land-defence"), or militia, for nine years, with liability to be called upon for annual practice, and to be incorporated in the regular army in time of war. Leaving the *Landwehr*, he is finally enrolled in the *Landsturm*, which body is only called upon for service within the frontiers of the country. Exemptions are made in favour of the nobility, clergy, and some other classes. A certain amount of education and fortune constitutes a partial exemption, as young men of twenty, who pay for their own equipment and pass a light examination, serve only one year in the army. But in this case the liability to service in the army of reserve, the *Landwehr* and the *Landsturm*, remains the same. Altogether, setting aside a few exceptions, the whole male population of Prussia may be said to be trained to arms—ready for offensive warfare, either in the army or the *Landwehr*, from the age of twenty to that of thirty-six; and for defensive warfare, within the country, till the age of fifty. See GERMANY.

When a war is imminent, the government decrees the mobilization of the whole army, or of such a portion as

may be deemed necessary. In preparing for the campaign in 1866, the whole field army and the first levy of *Landwehr* were mobilized in fourteen days; and at the declaration of war by France in 1870, the mass of the troops was brought to the Rhine in twelve days. Every commanding general mobilizes his own corps d'armée, and the commandants of those fortresses which are ordered to be placed in a state of defence take their own measures for strengthening the fortifications.

Though every man in Prussia is a soldier, there are not many among the privates who make soldiering a profession, and re-enlistments are not very numerous nor much encouraged. If a man wishes to re-enlist after the completion of his three years' term of service he is allowed to do so, provided the general commanding his brigade approves him; but he only re-enlists for one year, at the end of which either party can break off the engagement, or, if both consent to continue, a re-enlistment can be effected for another year, and so on. In the time of war the soldier cannot break off his engagement at the end of the year, but must continue it till the war is over. At any time he can be discharged for misbehaviour. A man who re-enlists, generally, if well educated, becomes a non-commissioned officer, but neither the pay nor position of a non-commissioned officer is high enough to induce men to stay long in the army under ordinary circumstances. But an inducement which is found quite powerful enough to keep men sufficient to form all the non-commissioned officers of the Prussian army is afforded by the fact, that after a man has served twelve years, during nine of which he has been a non-commissioned officer, he is certain of obtaining a good civil appointment; for all vacancies among railway and telegraph officials, government clerks, overseers of the public forests, gendarmes, non-commissioned officers of police, post-office clerks, and jailers, are filled from the ranks of the non-commissioned officers whose times of service in the army have expired. Official returns state that in no other European army is the mortality so small as in that of Prussia.

The formation of the Prussian navy [see GERMANY] only dates from 1848, and even up to 1864 it was very insignificant. But the result of the Danish War in that year, and the annexations made in 1866, rendered the possession of a powerful navy more than ever necessary to the welfare of Prussia. The sailors and marines are raised by conscription from among the seafaring population, which is exempt on this account from service in the army. Great inducements are held out for able seamen to volunteer into the navy, and the number who have done so in recent years has been very large. The total seafaring population of Germany is estimated at about 80,000.

Prussia has now four ports of war—Kiel, Dantzie, and Stralsund on the Baltic, and Wilhelmshaven in the Bay of Jade, on the North Sea. The last-named is the most important. It is a vast artificial construction of granite, and comprises five separate harbours, with canals, sluices to regulate the tide, and an array of dry docks for ordinary and iron-clad vessels.

History.—That portion of the Baltic shore which is now included in the kingdom of Prussia was formerly inhabited by Slavonic tribes, akin in customs and language to the Lithuanians. Little is known of their history, except that they came into occasional collision with wave after wave of the great Teutonic race as it flowed down from the icy North, until the tenth century, when they bore the name of Pruzi or Prutheni, and received their first knowledge of Christianity from Bishop Adalbert of Prague, whom they cruelly martyred in 997. Boleslas, duke of Poland, succeeded, however, about 1018, in effecting their conversion by the sword and in subjecting them to his sceptre. But they proved themselves an unruly people, and, after many futile insurrections, finally shook off the Polish yoke about 1161,

recovering their independence and returning to paganism. Shut out from the rest of Christendom, and holding aloof from its great movements, but at times making inroads upon neighbouring territories, they preserved their freedom, until their gradual advance into Pomerania alarmed the fears of the Christian powers; and Conrad, duke of Masovia, led the knights of the Teutonic order in a crusade against them. The struggle lasted over half a century. The Prussians fought desperately, but in the end chivalry and faith prevailed. They were almost exterminated, and the Teuton knights, taking possession of the country, colonized it with men and women of their own race, and founded the cities of Königsberg, Kulin, Marienwerder, Memel, and Thorn. For 200 years they preserved their supremacy; but all these knights and orders declined in mental power and moral strength when their mission was fulfilled, and so the Teutons, rapidly degenerating, gave way at last before the impetus of the burgher class. In 1511 they elected as their grandmaster the Markgraf Albrecht of Anspach and Baireuth, a scion of the Hohenzollerns. He was a man of will and capacity, who reinvigorated the order by renouncing Roman Catholicism and embracing Lutheranism, while he consolidated its influence by erecting Prussia into a duchy, whose crown he placed on his own brow in 1525.

Here it becomes necessary to trace, very briefly, the rise of the Hohenzollerns, who have made Prussia a prosperous and powerful country.

This family derives its name from the Alpine district and fastness of Zollern or Hohenzollern, in Suabia. It first emerged into historic notice towards the close of the twelfth century, when, in or about 1170, Conrad, a younger branch of the race, was appointed Burgraf of Nuremberg by the Emperor Frederick Barbarossa. His great-grandson, Frederick III., obtained Baireuth and other lands, in 1248, by marriage; and in 1273, Rudolph of Hapsburg, as a reward for his services in assisting him to the imperial crown, made the burgraviate a princely fief hereditary in Frederick's family. In 1331 one of his descendants purchased the margraviate of Anspach, in Franconia; after which they were quiet for many years. Then arose a notable man, Frederick VI., who lent money and lance to the Emperor Sigismund, and in return was invested with the hereditary electorate of Brandenburg (17th April, 1417). To raise the moneys which he lent to the emperor, Frederick sold the castle of Nuremberg and its rights over the town to the citizens, and thus the Nuremberg burgraves end where the Brandenburg electors begin. The Elector Frederick was a prince of singular intellectual energy, and deserves to be credited as the founder of the Prussian Hohenzollerns. He died in 1440, leaving a territory to his successors of 8048 English square miles.

He was succeeded by his son, Frederick II., surnamed Iron-teeth, who added to his dominions either by war, purchase, or marriage, Neumark (1455), Cottbus (1458), Pritz, Wernigerode (1469), and Turpitz (1462). In 1470, after increasing the Brandenburg electorate to 13,340 English square miles, he abdicated in favour of his brother Albrecht or Albert, surnamed Achilles for his warlike prowess, but who died in 1481, without having done much for the aggrandizement of his family. He is said in the *Dispositio Achillea*, an ordinance for regulating the family succession, to have first legally established the custom of primogeniture in Europe. Next to him came John, surnamed Cicero, in whose time the Hohenzollerns divided into two separate camps—the younger brother taking Anspach and Baireuth for his patrimony. He died in 1499, leaving Brandenburg (now reduced to 12,844 miles) to the Elector Joachim I. In the reign of this prince occurred the Reformation. He refused to accept its principles, though he did not persecute those who were more open to liberal sympathies. His cousin Albrecht, markgraf of Anspach and Baireuth, was,

as we have seen, a disciple of the new creed, and hence arose another division among the Brandenburg Hohenzollerns—a division caused by difference of religion.

Joachim II. broke with the Roman faith, though he did not join the Lutherans, but he would not oppose them, and the result was an outbreak of ill-feeling between the elector and the emperor, between the Hohenzollern and the Hapsburg, which was in after-years developed into jealous rivalry and continually increasing antipathy.

Joachim II. died in 1571. He was succeeded by Joachim George (1571–98), and he by Joachim Frederick, who became guardian of his son's father-in-law, the mad Duke Albert of Prussia, and at the same time regent of the duchy of Prussia (1605). He died in 1608, and was succeeded by his eldest son, John Sigismund, who in 1618, in right of his wife Anna, daughter of Duke Albert, received the hereditary infeoffment of the duchy of Prussia.

And now we must go back to the Markgraf Albrecht. After a long, equitable, and prosperous reign he died in 1550. He founded the University of Königsberg, established schools, and promoted the circulation of the Scriptures. His son and successor, Albert Frederick, having lost his reason, a regency was appointed. It was successively held by several of his kinsmen, and finally by the Elector John Sigismund, who, on Duke Albert's death, obtained the ducal crown.

Prussian history thenceforward flows in a well-defined channel, as the history, in effect, of the Brandenburg Hohenzollerns. John Sigismund coveting the duchy of Cleves-Juliers, to which he had some family pretensions, while the Emperor of Germany favoured the claims of the Elector of Saxony, he went over to the Reformed Church, and in the Thirty Years' War threw in his lot with the Protestants. That great war spread over nearly the whole Continent. On the one side stood the Hapsburgs, the Elector of Saxony, and the German Catholic princes; on the other, the Hohenzollerns, Sweden, and the Lutheran states of Germany. It was a dark and troublous time, and John Sigismund, spent with fatigue, died in 1619, at the early age of forty-five.

George William, who succeeded, desired to remain neutral between the Protestant and Catholic parties. The neutral result of this policy was that Brandenburg was invaded and wasted by both sides. This period of the Thirty Years' War is one of the three dark chapters of Brandenburg-Prussian history. This vacillating prince died in 1640, leaving his wasted and depopulated dominions to his son, Frederick William, called the Great Elector.

The Great Elector may be fairly termed the second builder up of the Brandenburg-Prussian state and the fortunes of the Brandenburg branch of the younger Hohenzollern line. He cleared his land of foreign troops, and resuscitated its prosperity. He obtained from Sweden (1648) Lower Pomerania and the principality of Camin, that of Halberstadt, the county of Hohenstein, and the principality of Minden. By an alliance with the Poles against the King of Sweden, he secured a recognition of the entire independence of the duchy of Prussia from all vassalage to the Polish state. In 1666 the Cleves-Juliers succession was at length amicably partitioned between him and the Count of Pfalz-Neuburg, the Great Elector receiving the duchy of Cleves and the counties of Mark and Ravensberg. As sovereigns of the duchy of Cleves, the Electors of Brandenburg first became owners of territory on the left bank of the Rhine. In 1680 the duchy of Magdeburg reverted to Prussia.

The year 1672 is memorable as having brought France and Brandenburg-Prussia for the first time into direct collision. When Louis XIV. declared war against the Netherlands, the Great Elector formed an alliance with the invaded party. In retaliation the French troops occupied Cleves. Austrian jealousy contrived to hamper

the activity of the Brandenburg troops in this war against France, and even caused their defeat at Mülheim. Austria treacherously made a separate peace with France, and the Brandenburgers, left in the lurch, was obliged to sign the treaty of St. Germain-en-Laye, by which most of the territory he had just wrested from Sweden was lost to him. It was then that he gave vent to his bitterness against the emperor in these memorable words—*Exoriare aliquis nostris ex ossibus ultor* ("An avenger shall rise up out of our bones").

In one thing the Great Elector was entirely unsuccessful—to wit, in prevailing upon the emperor to cede to him the principalities of Jägensdorf, Liegnitz, Brieg, and Wohlau, in Silesia, which had reverted to him in right and law, but which the emperor refused to give up, a refusal persisted in by successive Hapsburgs, and the eventual cause of the Seven Years' War. He died on 9th May, 1688, leaving to his successor a fine army of 38,000 men, a well-filled treasury, and a territory of 43,222 English square miles.

He was succeeded by his second son (his eldest having predeceased him), Elector Frederick III., the twelfth and last of the electors. His war with Louis XIV. was ended by the treaty of Ryswick, and for the sum of 300,000 thalers he bought from the spendthrift Augustus, king of Poland, Quedinburg, and a few other places.

He now applied for permission to the emperor to assume the kingly title, and the imbroglio called the contested Spanish Succession induced him to give way in consideration of Prussian aid in the long war which he foresaw was imminent. In November, 1700, therefore, he agreed to acknowledge the Elector of Brandenburg as King of Prussia, on condition that the latter would maintain an army of 10,000 men in the Austrian interest during the Seven Years' War; that the electoral vote of Brandenburg should always be given on the Hapsburg side; and that in the College of Princes the future kings of Prussia should only sit as plain electors; lastly, that all moneys due by Austria to Brandenburg should be regarded as paid. On these hard conditions did the Hohenzollern win his regal title from the Hapsburg. Frederick III. then betook himself to Königsberg, the capital of his Prussian duchy, and placed crowns upon his own and his wife's head, 18th January, 1701. He thenceforth called himself Frederick I., and his title was immediately acknowledged by the sovereigns of the Protestant and the Austrian interests in Europe. Spain and France recognized him as king in the treaty of Utrecht in 1713. Poland and the Pope held out longer. Poland only recognized its *ex-dévant* vassals of Brandenburg as kings of Prussia in 1764. Pope Clement XI. published a brief warning all orthodox sovereigns from assenting to this elevation of an heretical power; and it was only in 1786, after the death of Frederick the Great, that the Romish State Calendar acknowledged that there was such a person as a king of Prussia!

The roll of the Prussian kings is as follows:—

1. Frederick I.,	1701
2. Frederick William I.,	1713
3. Frederick II., called "The Great,"	1740
4. Frederick William II.,	1786
5. Frederick William III.,	1797
6. Frederick William IV.,	1840
7. William I.,	1861

Through his relationship to the house of Orange, Frederick I. acquired the counties of Meurs and Lingén in 1702, the former being situated on the left bank of the Rhine, the latter in Westphalia; the county of Tecklenburg, in Westphalia (1707); and the principality of Neuchâtel, in Switzerland, in the same year. Frederick I. left Brandenburg-Prussia with an area of 45,080 English square miles, and a population of 1,731,000 souls.

Frederick William I. acquired the duchy of Gueldres in consideration of his renunciation of all further claims on the inheritance of the house of Orange. As the result of his war with Charles XII. of Sweden, he obtained Hither Pomerania as far as the Peene, Stettin, the islands of Usedom and Wollin, and the towns of Damnu and Golnow, paying, however, to Sweden the sum of 2,000,000 thalers by way of compensation. He helped the Hapsburg against Louis XV., in the war of the Polish succession, with a contingent of 10,000 men. He left to his famous son a territory of 47,911 English square miles in area, and a population of 2,486,000 souls. Not only was the state unencumbered, but the treasury contained about 9,000,000 thalers. His tried and well-appointed army numbered 85,000 men.

To a kingdom thus efficiently organized, Frederick II., better known in history as Frederick the Great, brought the powerful impulse of a comprehensive intellect and an extraordinary military genius, and the result was, that at the close of the Seven Years' War, in 1763, Prussia, as we shall see, found herself a first-class European power. When Austria became embroiled in the confused labyrinthine politics of the contested succession, Frederick took advantage of her position to revive the claims of the Hohenzollerns to portions of Silesia, but it was not until Maria Theresa refused to admit the justice of his pretensions that he took up arms against her. In two campaigns he overran the whole of Silesia and the county of Glatz, thus avenging upon the Hapsburgs the wrongs they had inflicted upon the Great Elector.

Maria Theresa, however, was a woman of dauntless spirit, and by laborious secret intrigues she contrived to form a European coalition against Prussia, with the view of reducing her king to the position of Elector of Brandenburg. The war which followed was a death-struggle. Frederick knew that Prussia, if conquered, would vanish as an independent kingdom from the map of Europe. His sole ally was England, who supplied him liberally with money and men. But the odds against him were terrible, and it is impossible for any one to read without emotion the story of the great king's superhuman exertions, his alternate successes and disasters, and his final triumph, as sketched by Lord Macaulay, or told with picturesque detail by Carlyle. France and Russia, disheartened and overreached, retired from the contest in 1761, and England then consented to become neutral in a struggle which involved only Austria and Prussia and ceased to menace her interests. Deserted by her allies, and beaten on almost every field, the empress-queen at length submitted to the inevitable, and in February, 1763, the peace of Hubertsburg put an end to the conflict which for seven years had ravaged Germany. Frederick ceded nothing. The whole of Europe in arms had proved unable to wrest Silesia from his grasp. See SEVEN YEARS' WAR.

His was safe. His glory, says Macaulay, was beyond the reach of envy. If he had not made conquests as vast as those of Alexander, of Cæsar, and of Napoleon, if he had not, on fields of battle, enjoyed the constant success of Marlborough and Wellington, he had yet given an example unrivalled in history of what capacity and resolution can effect against the greatest superiority of power and the utmost spite of fortune.

The remainder of his brilliant reign was devoted to the re-organization of his army, the recruitment of his resources, and the general consolidation of his exhausted kingdom. By the iniquitous partition of Poland, in 1773, he added to his territories the greater portion of what is now known as Western Prussia. On his death, in 1786, he left to his successor, Frederick William II., a state of 77,224 English square miles, a population of 5,430,000, a revenue (unencumbered with debt) of 22,000,000 thalers, and a balance in the treasury of 70,000,000 thalers.

The reign of Frederick William II. was distinguished by the second and third partitions of Poland (1793 and 1795), which increased the power, if they did not add to the glory, of the Hohenzollerns. Frederick William III. came to the throne (1797) at a time when Europe was convulsed by the throes of the French Revolution, when the old landmarks of policy were fast disappearing, and the independence of every European state was threatened by the preponderant military force and national enthusiasm of republican France. Prussia remained neutral for some years, her neutrality having been purchased by the bribe of 4000 square miles of territory and 600,000 souls; but she had the misfortune to see her influence in Europe daily declining, and her ancient allies charged by her selfish apathy into secret enemies. The insults and exactions of Napoleon, acting upon her mortified spirit, roused her into an energetic vindication of her liberty. She declared war against France, but fighting almost single-handed, was crushed at the great battles of Jena and Auerstadt (October, 1806). Napoleon entered Berlin, and dictated to the humiliated king what terms he chose. His exactions roused a deep wrath in the hearts of the Prussians, a wrath which flamed forth at the slightest spark; and when the Russian disasters of the French emperor, and Wellington's successes in Spain, showed that the imperial Colossus was tottering to its fall, the people rose *en masse* at the summons of the king to expel the hated French from fatherland. A Prussian army entered France, and paraded its victorious colours in Paris. Then came the Hundred Days, and the glorious field of Waterloo, where Blücher and his soldiery came up in time to convert a drawn battle into a complete victory. Once more the Prussians marched triumphantly through the streets of Paris, and were only restrained by Wellington's influence from wreaking their vengeance on the humbled Parisians. The treaty of Vienna, in 1815, greatly augmented Prussian power, and gave the kingdom those extensive, but ill-defined frontiers which it possessed until the outbreak of the Danish War. Its area included 110,980 square miles, with a population of 10,349,031 souls.

Frederick William III., guided by his able minister, Count Hardenberg, now addressed himself to the reorganization of the state; making commercial treaties with other European nations, promoting education, encouraging trade, establishing steam and sailing packets on the great rivers, founding the German customs league of the Zollverein, and neglecting nothing which could conduce to the prosperity of Prussia, except the constitutional freedom of its people. To this latter cause, and to the despotic centralization of its government, are due the disputes between the Parliament and the Court which have prevailed for a quarter of a century. The great object of the Prussian government, however, was the organization of a military force which should enable it at the proper time to wrest from Austria her supremacy in Germany. For this purpose it laboured silently but incessantly to provide the great bulk of the population with an efficient military training. Warned by the disasters of Austria in the Franco-Italian campaign of 1859, it furnished its soldiers with the needle-gun, raised the annual supply of recruits from 40,000 to 63,000, and created an army 350,000 to 380,000 strong, with a first reserve of 100,000 men. The present sovereign found a daring and sagacious counsellor in Prince von Bismarck, whom a series of events elevated to the principal position in the government, and matters were soon ripe for the contemplated struggle with Austria. The Schleswig-Holstein question then arose; and Prussia was enabled, by the bold spring she took to the leadership in action against Denmark, to place Austria in the secondary position of a half-willing ally. Denmark once crippled and beaten into submission, it remained only so to carry on the system of joint occupation of the duchies as to force

Austria from one concession to another into direct hostility; and while degrading her first by policy, to pretend just so much reluctance to quarrel as might ward off foreign interference, and prevent the Austrian emperor from arming for war. This scheme was carried out with the utmost astuteness and with complete success. The neutrality of France was secured by secret promises (which, however, were not fulfilled), and the alliance of Italy by the undertaking to assist her in wresting Venetia from the Austrian grasp.

Then came the Ten Days' war of 1866. Prussia launched 260,000 men, armed with the needle-gun, against Austria's 200,000, armed with the muzzle-loading rifle. The contest was as sharp as it was brief. At Königgratz and at Sadowa the Austrian armies were annihilated; and the Kaiser, ceding Venetia to France, to be restored through France to Italy, was compelled to conclude a hasty peace at Nikolsburg, which acknowledged Prussia as the paramount power of Germany. Austria withdrew from the German Confederation; and Prussia, forming a North German Confederation, virtually annexed to her dominions Hanover, Hesse, Nassau, and Saxony. The Saxon kingdom was, indeed, left nominally intact; but its capital was garrisoned by Prussian troops, and its soldiery incorporated in the Prussian army. The result of the war was to increase the population of the Prussian territories by 5,000,000 souls, and to augment her military resources nearly one-half. Prussia was now, indeed, the leading military power in Europe. She had gradually amalgamated and consolidated the annexations made during the struggle, and had not, perhaps, met with more opposition than was to be expected from the somewhat arbitrary and high-handed way in which those annexations were made.

In the spring of 1867 war seemed imminent between France and Prussia respecting the occupation of the fortress of LUXEMBURG by the latter, but it was averted by the holding of a conference of the European powers in London, where it was decided that the territory should be considered as neutral ground.

The struggle, however, which in Prussia had been foreboded for years, could not long be deferred, and in 1870 the pent-up bitterness and jealousies of the two nations burst forth in one of the most sanguinary wars of modern times. In June, 1870, the throne of Spain was offered to and accepted by Prince Leopold of Hohenzollern-Sigmaringen. The Emperor Napoleon objected to this arrangement, and the prince withdrew his candidature; but the refusal of the King of Prussia to guarantee that a prince of the house of Hohenzollern should not at any time accept the Spanish crown was made the pretext for a declaration of war by France, and the armies of both countries were hurried towards the Rhine. War was declared on 15th July, 1870, and it was intended, by a rapid invasion of South Germany, to isolate these states, and perhaps secure their alliance against the northern confederation. A remarkable series of faults, however, in the French organization caused delays which were fatal. The forces of Prussia and the confederate states were swiftly mobilized, and after a little hesitation were joined by those of the South German states. The Crown Prince of Prussia advanced into the enemy's country, and on the 8th of August attacked the French at Wissemburg. Taken completely by surprise, the intending invaders of Prussia were overpowered and forced to retreat. On 6th August there followed in quick succession the desperate battles of Woerth and Spicheren. Marshal MacMahon's army was again defeated by the Crown Prince; and while the remnant who escaped from Woerth were dispersing in all directions, the French army of the Rhine was beaten by the main German army, under the immediate command of the King of Prussia. Later on in the same month came the hotly-

contested actions around Metz, resulting in the French being driven into that fortress, which was then besieged. Pushing rapidly on the Prussians outmarched and surrounded, near the Belgian frontier, the only French army now in the field; and the first few days of September brought Sedan, the capture of an entire army and of the emperor, the revolution at Paris, the downfall of the dynasty, and the establishment of a provisional government. Paris was soon besieged, the various strongholds of France fell one after another, a third of the country was overrun with victorious German troops, and it became clear that, despite the heroic efforts of France, the King of Prussia's ultimate triumph was certain. Such a wonderful and unexpected course of success caused the most intense excitement throughout Germany, and quickened the long-cherished aspiration for national unity. Prussia, as the greatest and most powerful of the German states, naturally took the lead in the movement, and one after another the rest, including Bavaria, gave in their adhesion to the proposed empire. A deputation was appointed to wait upon the King of Prussia, and request his acceptance of the title and dignity of Emperor of Germany. His consent having been obtained, he was crowned with great pomp and solemnity at Versailles, on 18th January, 1871, and was the same day proclaimed in Berlin amid universal rejoicing. See GERMANY.

PRUSSIA, properly so called, formerly designated by the name of the Kingdom of Prussia, afterwards divided into the two provinces of East and West Prussia, then formed into one province called the Province of Prussia, was again in 1878 divided into the old separate provinces of East and West. The provinces are bounded on the N. by the Baltic, which washes the coast for about 220 miles; on the E. by Russia; on the S. by Poland and Posen; and on the W. by Brandenburg and Pomerania. The area is 24,880 square miles, and the population is 3,339,834.

The climate is temperate and healthy, though very cold in winter, changeable on the coast, and generally rather damp. The face of the country is level, but broken here and there by low ranges of hills. The principal rivers are the Vistula, the Pregel, and the Niemen. There are about 300 small lakes in East Prussia, and 150 in West Prussia; but no large lakes, unless we reckon as such the two Haffs, which communicate with the sea only by canals, and have fresh water. The soil varies, but is generally fertile, particularly the delta of the Vistula and the country watered by the Niemen. The provinces produce wheat, rye, flax of excellent quality, hemp, tobacco, hops, madder, potatoes, and timber. The inhabitants live chiefly on rye, and the largest quantity of the wheat is exported. There are good breeds of the usual domestic animals (including more horses than any other province in the kingdom), abundance both of fresh-water fish and sea fish, and bees. The mineral kingdom is very poor; iron, however, in various forms is abundant, and amber is far more plentiful in this province than in any other part of the world. The manufactures are confined to the towns, of which the principal are DANTZIC and KÖNIGSBERG.

After the Goths left the shores of the Baltic, they were succeeded by different Slavonian tribes. Conrad, duke of Masovia, being unable to defend his country against these mercenaries, called to his assistance the Teutonic knights, to whom he assigned, in 1230, a tract of land on the Vistula, where they built Thorn and Culm. The knights retained possession of this country, called East Prussia, till 1525, when it was made a grand-duchy, and given to Albert of Brandenburg, their grand-master, as a fief of Poland. West or Royal Prussia also formerly belonged to Poland, when Dantzic was its capital.

PRUSSIAN BLUE, a pigment of a pure dark blue colour, accidentally discovered in 1704 by Diesbach, a colour maker in Berlin. It is prepared by adding excess

of a ferric salt to solution of ferrocyanide of potassium or yellow prussiate of potash, and washing and drying the blue precipitate. It consists of hydrated ferric ferrocyanide ($\text{Fe}_7\text{Cy}_{18}\text{H}_{20}\text{O}$). Another blue pigment, known as Turnbull's blue, is made by the addition of ferriocyanide of potassium or red prussiate of potash to ferrous sulphate. Pure Prussian blue is very dark in colour, and has a coppery lustre and conchoidal fracture. It possesses great body and covering power, and mixed with chrome yellow forms a rich green. It is extensively used as a pigment in calico printing and dyeing.

PRUSSIC ACID. See CYANIDES.

PRUTH, the *Porata* of Herodotus, a large navigable river, rises in the Carpathian Mountains, flows for about 30 miles to the north, and then to the east through the Buckowina into Moldavia. It receives numerous tributaries, and is itself the last great affluent, on the left, of the Danube. From the point at which it leaves the Buckowina, it formed for the remainder of its course, after the peace concluded at Bucharest in 1812 up till 1857, the boundary between the Russian province of Bessarabia and Moldavia, and this boundary was again reverted to after the Treaty of Berlin in 1878. After a course of nearly 400 miles, it joins the Danube at Reni, 75 miles from the Black Sea.

PRYNNE, WILLIAM, a celebrated pamphleteer and politician, born in 1600 at Swainwick, near Bath, took his B.A. degree in 1620, and was soon afterwards called to the bar. He became attached to the Puritan party, and in 1632 published a virulent pamphlet called "Histrio-mastix, or a Scourge for the Stage-players;" for which the Star Chamber fined him £3000, ordered him to be expelled from the University of Oxford and the Society of Lincoln's Inn, and degraded from the bar, to be set twice on the pillory, to lose both his ears, to have his book burned by the common hangman, and to be imprisoned for life. Three years afterwards, while imprisoned in the Tower under the above sentence, he published another pamphlet, entitled "News from Ipswich," reflecting severely upon the hierarchy generally, and upon Laud and several of the bishops in particular. For this publication he was again prosecuted in the Star Chamber, and received a severe sentence. He was imprisoned in Carnarvon Castle, and subsequently in the island of Jersey. Public opinion meantime declared itself strongly against these proceedings. In 1641 he was liberated by the Long Parliament, and his sentence declared illegal. He was soon afterwards returned as a member of that Parliament for Newport, in Cornwall; and was made a bencher of Lincoln's Inn and recorder of Bath. He took no part in the proceedings of the later years of the Long Parliament, and immediately before the king's trial he was ordered into the custody of the sergeant-at-arms for "denying the supremacy of Parliament" in a pamphlet entitled "The Memento." On 6th December, 1648, he was, together with many of his faction, ejected from the House of Commons. From this time he became a bitter enemy of Cromwell and the military party; and in consequence of his writings against them was again imprisoned for several years in Dunster Castle, in Somersetshire, and Pendennis Castle, in Cornwall. On his release, in the early part of the year 1660, having returned to his seat in the House of Commons as an excluded member, he is said, in a letter to General Monk, to have "exceedingly asserted the king's right."

Soon after the Restoration he was appointed keeper of the records in the Tower, an office for which his habits of study peculiarly fitted him. He died 24th October, 1669.

Prynne was a most laborious and voluminous writer. A catalogue of his works (which consist of nearly 200 volumes) is given, after an account of his life, in Wood's "Athenæ," vol. iii., p. 844, edit. Bliss.

PSALMODY, in its widest sense, signifies the Psalms of David set to music and sung. But from the early part

of the sixteenth century the term has been applied only to metrical versions of the Psalms, to which short grave airs are either set or adapted.

Among the inferior orders of clergy in the Church of Rome were the Psalmists, whose first institution appears to have been at the commencement of the fourth century. It is believed that this order was established for the purpose of encouraging and regulating the ancient psalmody. By degrees the greater part of the psalm-tune was surrendered to a single voice, the congregation joining only at the close. This led to a more scientific, and perhaps a more refined mode of singing, requiring superior knowledge; but Huss, and afterwards Luther and Calvin, restored to the people their share in the divine service, furnishing them at the same time with the means of performing it in a manner agreeable to themselves and conformably to what they conceived to be the true principles of public worship. With this view the Psalms were turned into metre, tunes were composed or adapted, and the practice of psalmody soon became a marked distinction of those who departed from the Church of Rome. Luther, however, was friendly to harmony, or music in parts; the severe Calvin, on the contrary, sternly refused to admit anything but simple unaccompanied melody. Marot and Beza translated the Psalms into French verse; and Sternhold and Hopkins (1562) into English verse. Who composed the most popular and permanent psalm tunes is a question involved in much obscurity.

The first complete collection of psalm tunes for four voices deserving notice was published in 1621, by Thomas Ravenscroft, Mus. Bac., to which Tallis, Morley, Dowland, and all the great masters of the day contributed. The name of John Milton, the father of the poet, also appears there as the composer of "York" and "Norwich" tunes. The editor supplied many, some of which are still in use; and to his collection all the numerous works of the kind since printed have been much indebted. In the year 1677, John Playford, a good musician and a most useful, industrious editor, printed, in 8vo, the famous "Whole Book of Psalms in three parts" (his "Psalms and Hymns in Solenne Musick of four parts" had already appeared in 1671), in which he has judiciously given the melody to the soprano voice, to which it naturally belongs, and it ever since has retained that place, instead of being given, as before Playford's time it was, to the tenor. Dr. Miller, of Doncaster, about the year 1800, effected a considerable improvement in psalmody by his "Psalms of David for the use of Parish Churches," in which the version of Tate and Brady was employed, and drove Sternhold and Hopkins from many of their strongest positions. But the rise of the hymn under the influence of Dr. Watts and succeeding writers has proved quite irresistible, and the versified psalms are now almost obsolete in church music. The psalms of the day are chanted in the original prose in cathedrals and many churches, while the old psalm tunes, with vast numbers of modern tunes added, are now turned over to the service of hymns.

PSALMS, BOOK OF, the first book in the Hagiographa division of the Hebrew Scriptures. The present Hebrew title of the collection is *Tehillim*, Songs of Praise, though in the actual superscription of the psalms the title *Tehillah* is applied only to Psalm cxlv. Other titles borne by single hymns are *tephillah*, prayer (Ps. xvii., lxxvi., xc., cii., cxlii.); *shir*, song (Ps. xvi.); *mizmôr*, a rhythmical composition, applied to forty-five psalms; *mizmôr-shîr*, a psalm song, applied to eight; *maschil*, instruction; *michtam*, a song with a deep purport; and *shigayon*, a lyrical or dithyrambic poem. The Septuagint adopts the title *Psalmoi*, a name used also in the New Testament, and the writer of the Epistle to the Hebrews, dropping the term Psalms, quotes from the collection under the name of "David" (Heb. iv. 7). In its present form the collection

is divided into five books, each of which, save the last, closes with a doxology, the divisions being made up as follows:—Book i., Ps. i.–xli.; book ii., Ps. xlii.–lxxii.; book iii., Ps. lxxiii.–lxxxix.; book iv., Ps. xc.–cvi.; and book v., Ps. cvii.–cl. These divisions are referred to by the fathers, and they evidently date from pre-Christian times, but, from internal evidence, many modern scholars consider that the present division does not represent the original scheme of the Psalter, and a different grouping, which would unite books ii. and iii. and books iv. and v. into single collections, has been recently suggested. Among the reasons advanced in support of the latter suggestion, the most important is that which is based upon the use of the divine titles Elohim and Jehovah. In the first division the name Jehovah occurs 272 times, and Elohim only fifteen; in the second book Elohim occurs 164 times, and Jehovah only thirty; in the third Elohim preponderates in the earlier and Jehovah in the latter psalms of the book, the numbers being for the whole, Jehovah forty-four, and Elohim forty-three; in the fourth and fifth books Elohim occurs only in seven places, while the name Jehovah is found in 339. With respect to the date of the collection, external evidence, derived from the existence of the Septuagint, shows that the book had been accepted and recognized as forming part of the canonical Scriptures earlier than 130 B.C., but beyond this the external evidence of the completion of the collection does not go. The traditional opinion of the Jews was that the foundation of the temple psalmody was laid by David in anticipation of the erection of the building itself, just as Moses was supposed to have prepared a law for the Holy Land into which he was not permitted himself to enter. David was not supposed to be the author of all the psalms, for it was asserted by the Talmudic writers that Ezra incorporated psalms by ten other authors, Adam, Melchizedek, Abraham, Moses, Heman, Jeduthan, Asaph, and the three sons of Korah. To these the name of Solomon was added for Ps. lxxii. and cxxvii.; but in the Septuagint the first of these is marked *of* and not *by* Solomon, and it omits altogether his title to the latter. To Adam was assigned the Sabbath psalm, xcii., to Melchizedek Ps. cx., while Abraham was identified with Ethan the Ezrahite of Ps. lxxxix. A different tradition, based upon a general rule, which ascribed all anonymous psalms to the author of the nearest preceding piece having a name attached, made Moses the author of Ps. xc.–c. inclusive. It would seem also, from Matt. xxii. 42–46, that Ps. cx. was accepted at the time of Jesus, in accordance with its title, as Davidic, but the use of the argument given in Matthew by the Christians probably induced the rabbis to assign the psalm to Melchizedek. With respect to the remainder, the inscriptions in the Hebrew text assign seventy-three psalms to David, to which the Septuagint adds eleven; twelve bear the name of Asaph; eleven are given as "written by the sons of Korah;" Jeduthan's name appears in the titles of three; and there remain fifty songs which are anonymous. The questions remain, Do these inscriptions form an integral part of the Hebrew Scriptures? and if not, how far are they to be trusted? The first of these questions must be answered unhesitatingly in the negative—these titles most certainly do not form part of the original text in the great majority of instances. With respect to the second question, it is not so easy to give an answer, for while it is abundantly evident from the language, the structure, and the references of the psalms that many of them are erroneously inscribed, there are others the composition of which it is by no means easy to assign to a definite period. Some modern critics go so far as to deny the Davidic authorship of any of the poems in the collection, and others ascribe to him merely eight or nine of the older pieces, but these results of criticism have not yet obtained general acceptance. Like all other questions connected with the Old Testament, the date assigned to the psalms

will depend very much upon the view taken of the course of Jewish history, and if the theory of Wellhausen, noticed under PENTATEUCH, is adopted, the composition of the psalms must be assigned to a date much later than that hitherto accepted. Thus it has been an opinion very generally received up to a recent period, that the first collection of the Psalms was made by or under the direction of David, the second in the time of Hezekiah, the third at a later period in the history of the kingdom, the fourth before the writing of the Chronicles, and the fifth after the return from the Captivity, the whole being finally revised and edited by Ezra and Nehemiah. If, however, we accept the conclusions of Wellhausen, it would hardly be possible to assign the collection of the first book to a period earlier than the building of the second temple, though individual psalms may have been composed during the last centuries of the kingdom. The compilation of the second and third divisions must be placed later, possibly during the fourth century B.C., and the fourth and fifth divisions assigned to the first half of the second century B.C.

The number of the psalms in the Hebrew text is 150; the Septuagint version has an additional psalm, plainly apocryphal, ascribed to David when he fought with Goliath. The text used by the LXX. corresponds very closely with the existing Hebrew, but there are several differences of arrangement, separate psalms in the Hebrew being joined in the Septuagint, and others presented singly in the Hebrew being divided in the Greek. These differences in the Septuagint, which are followed by the Vulgate, are given in the following table:—

Hebrew.	Septuagint.	Hebrew.	Septuagint.
Ps. i.-viii. .	i.-viii.	Ps. cxvii.-cxlvi.	cxvi.-cxlv.
" ix., x. .	ix.	" cxlvii. .	cxlvi., cxlvii.
" xi.-cxlii. .	x.-cxlii.	" cxlviii.-cl.	cxlviii.-cl.
" cxiv., cxv. cxlii.		" cl.	cl.
" cxvi. .	cxv., cxvi.		

With respect to the mysterious titles affixed to many of the psalms, it is generally supposed that they are either liturgical or musical directions to the singers. Such phrases as *Aijeleth-hash-shahar*, the hind of the morning; *Shoshannim*, lilies; *Jonath elon rehokim*, the dove of the distant terebinths; *Shushan eduth*, the lily of testimony, &c., are most probably the names of well-known tunes to which the psalms had been set, the temple music being apparently based upon the popular melodies of the nation. The obscure *Selah*, which occurs seventy-one times in the Psalms, and which the Septuagint renders *Diapsalma*, or interlude, was perhaps a sign or direction to the singers. It is plainly a musical term, but seeing that such authorities as Aben Ezra, R. Eliezer, Ewald, and Davidson are altogether at variance as to its signification, it must be confessed that we are entirely in the dark as to its meaning. Some of the remaining terms, such as *Neginah*, *Muth labben*, *Mahalah-leannoth*, *Gittith*, *Alannoth*, &c., must also be placed in a similar category, as the best authorities are greatly divided as to their interpretation.

Having thus noticed the principal questions involved in the authorship of the Psalms, it may be observed that though they were collected and composed for liturgical purposes, they may, from a literary point of view, be termed the national ballads of the Hebrew race; and further, apart from all religious questions, they must, from their force, majesty, and beauty, be assigned the highest place in the national lyric poetry of the world. As religious poems they embody the loftiest and holiest feelings of the saints of the old Hebrew nation, and so closely allied are the essential elements of human life in all ages of the world, that men have turned to them during all the centuries that have elapsed since they were composed, for guidance, instruction, and consolation, and have found in them chosen words to express the deepest spiritual emotions of their

souls. It has been well said that the Psalms touch every note in the vast diapason of humanity; they reach the outcasts of a great city as readily as those who sit in kings' palaces. In our various moods of thankfulness, complaint, belief, doubt, joy, melancholy, despair, and triumph they have ever a voice for and a response to our emotions. In the public and the home life of the Jews the Psalms have ever played an important part, while the Christian church in all its branches has ever adopted the Book of Psalms as the chief book of devotional poetry. It is quoted or plainly referred to in the New Testament over seventy times, and it was with words chosen from a psalm that the Lord Jesus breathed out his soul upon the cross. "No other book," says Dean Stanley, "has played so large a part in the history of so many human souls. By the Psalms Augustine was consoled on his conversion and on his deathbed. By the Psalms Chrysostom, Athanasius, Savonarola were cheered in persecution. With the words of a psalm Polycarp, Columba, Hildebrand, Bernard, Francis of Assisi, Huss, Jerome of Prague, Columbus, Henry V., Edward VI., Ximenes, Xavier, Melancthon, Jewell, breathed their last. Psalm lxxviii. cheered Cromwell's soldiers to victory at Dunbar. Locke in his last days bade his friend read the Psalms aloud, and it was while in rapt attention to the words that the stroke of death fell on him. Lord Burleigh selected them out of the whole Bible as his special delight. They were the framework of the devotions and of the war-cries of Luther; they were the last words that fell on the ear of his imperial enemy Charles V."

An enormous mass of literature has gathered round the Psalms, and commentaries and expositions, exegetical, historical, and devotional, literally abound. Our limits will only permit of a reference to a few of the more recent works:—Ewald, "Dichter des alten Bundes," first two half volumes (2nd ed. Gott., 1868, Eng. trans. 1880); the commentaries of Hitzig (1836, 1863-65), that of Delitzsch (1859-60, Eng. trans. 1871), and that of Hupfield (2nd ed., 1867, two vols.); Perowie, "The Book of Psalms" (5th ed., 1883); the work of Lowe and Jennings (2nd ed., 1885); and the translation of Cheyne (1881). Kuenen's "Onderzoek" (vol. iii. 1865) contains a valuable list of works bearing upon the Psalms up to the date of its publication; and a book published in 1843, under the title of "Records, Biographical and Literary, of 150 authors who have rendered the whole or part of the Book of Psalms into English verse," contains much curious information.

PSALTERY (Gr. *psalt-erion*, from *psallein*, to pluck, as one does the strings of a harp), an ancient musical instrument of the harp kind, in use among the Jews, and supposed by some to have been the nebel mentioned in several of the Psalms. Whether this instrument was played on by the finger or struck by a plectrum, seems doubtful; the probability is that it took many forms, and was played in both ways. It was in shape usually a trapezium, and similar to, if not the same as, the dulcimer, differing only in its mode of playing.

PSAMMETIK I. (twenty-sixth dynasty), whom the Greeks called *Psammetichos*, was that one of the ancient Pharaohs who opened Egypt to foreigners. His reign was from about 664 to 610 B.C. Hitherto Egypt had been as zealously guarded from intrusion as was Japan up to our own time; but Psammetik, who was, strictly speaking, a usurper, in the course of early vicissitudes learned the power of the Greeks, used them triumphantly as mercenaries, and after consolidating his rule, established them in a settlement upon the Pelusiac Nile, near Bubastes. He gave them a number of Egyptian children, and these latter were trained as interpreters by this means. The action of the king displeased his subjects greatly, but was eminently successful so far as he himself was concerned, and his Greeks were very faithful subjects. The Greek poet Terpan-dros took advantage of this privilege of entrance

into Egypt, and learned the Egyptian music, thus founding the musical system of Greece, which rested upon an ancient Egyptian basis. This is the true version of that Greek myth which, with pardonable national vanity, depicted Terpandros as "taking the lyre of Hermès to Egypt, and teaching its use to the Egyptian priests." Not only music, but many other arts passed from Egypt into Greece, and two generations later Pythagoras brought also philosophy thence. There were two other kings of the twenty-sixth dynasty who bore this name, but neither of them was of any great importance.

PSAMMITE (Gr. *psammos*, sand), a scientific term proposed by Naumann to denote the various kinds of rock comprised under the more familiar name of sandstone. It is widely adopted by modern petrologists.

PSSELAPHIDÆ is a family of beetles, usually classed with the BRACHELYTRA, although the tarsi have only three joints. They agree with this group in the short wing-covers (elytra) and the horny texture of the upper side of the abdominal segments, but the antennæ vary greatly in shape and number of joints. The Pselaphidæ are found in all parts of the world, and are all of minute size, scarcely any exceeding one twelfth of an inch in length. They prey upon other insects still smaller than themselves, and are found under stones and among herbage, especially in damp situations; some species are found under the bark of trees and in putrid wood. They are often collected during the winter months by shaking the moss from the roots of trees, or from old walls, over a piece of white paper or cloth. The species of the genus *Claviger* are found in ant nests, where they are said to be carefully tended by the ants for the sake of a liquid exuded from certain hairs on the wing-covers, and from a cavity on the upper side of the abdomen. These insects are blind and incapable of feeding themselves, the eyes having disappeared and the mouth being in a degenerate condition. *Claviger testaceus*, a British species, is common in the nests of the Yellow Ant (*Formica flava*).

PSEUDOMORPHISM (Gr. *pseudos*, false; *morphé*, form) is the occurrence of minerals in a crystalline form which does not correspond to their chemical composition; and the term is also applied to the process of replacement of organic remains by mineral matter during fossilization. Every such body is termed a *pseudomorph*. Of pseudomorphs proper there are three chief classes:—

1. *Alteration pseudomorphs*—(a) with loss of a constituent; (b) with gain of a constituent; (c) by exchange of constituents.

2. *Replacement pseudomorphs*.

3. *Paramorphs*.

In the first class there is always a chemical relation between the replacing and replaced substances, and the change is to a considerable extent of a truly chemical nature. In many granites, for example, the large crystals of felspar become decomposed into kaolin by the action of carbonated water, and the resulting earthy product retains the form of the original mineral; in this case there is a loss of constituents (potash, &c.) Malachite (basic carbonate of copper) is frequently met with in the crystalline form of cuprite (oxide of copper), having been derived from the latter by the addition of carbonic acid and water. And it is not unusual to discover limonite (hydrated oxide of iron) in the cubical form of pyrites (sulphide of iron), in which there has been an exchange of constituents.

In *replacement pseudomorphs* there is a complete substitution of one material for another, often without any relation to the chemical affinity between the displacing and displaced mineral matter. In the Triassic marls, for example, little cubes of hardened clay are often met with, which are undoubtedly pseudomorphous after crystals of rock-salt that have disappeared. *Hæmatite* (oxide of iron) in the crystalline form of calcite (carbonate of lime), which

it has replaced, may also be cited as a typical example of this class.

In *paramorphs* the percentage composition and form of the mineral have remained unchanged, but there has been a re-arrangement of the molecules, and a consequent alteration in physical characters.

In addition to the foregoing may also be mentioned the group of *epimorphs*, where one mineral presents the crystalline form of another simply by incrustation; thin layers of quartz, for example, are often deposited upon crystals of calcite, and thus present the appearance of the first occurring in the form of the second. (See Reinard Blum's "Pseudomorphosen des Mineralreichs," and Bischof's "Chemical Geology," vol. i.)

PSIDIUM. See GUAVA.

PSITTACI, an order of birds containing the PARROTS.

PSKOW, a town of Russia, the capital of the government of same name, is situated on the left bank of the Welikaja, nearly 5 miles from its mouth in Lake Pskow, and 162 miles direct south-west of St. Petersburg, or 171 by railway. It was a place of some importance nine centuries ago. At present the interior of the city has some resemblance to that of Moscow. In the centre of the town is the Kremlin, or citadel, on the steep left bank of the river. The middle town, extending in the form of a semicircle about the citadel, is also surrounded with a wall; a third very high wall, 5 miles in extent, defends the great town, which surrounds the middle town. The fortifications, erected in 1701 by Peter the Great, have almost entirely disappeared. Pskow has a cathedral, one Lutheran and numerous Greek churches, convents, and schools, an orphan asylum, &c. Among the public edifices are a handsome building for the government offices, the archiepiscopal residence, and the consistory. The population is over 18,000, who carry on some extensive leather manufactures. The town has a large export trade, chiefly in fish and flax, and an annual fair is held in it, at which great quantities of woollen, silk, and cotton fabrics, leather, books, jewelry, &c., are sold.

PSOCIDÆ is a family of insects belonging to the order NEUROPTERA. In this family the wings, especially the anterior pair, are large, and have few veins; in some species they are wanting. The body is generally short and soft, with a large head bearing a pair of long tapering antennæ. The Psocidæ are small insects, found chiefly in the temperate regions of the Old World. Most of them are found in crevices of the trunks of trees, on walls and old buildings, especially amidst lichens and mosses. In some species the females cover their eggs with a delicate silk web, which they spin from some part of the mouth. Other species never develop their wings, and are found among old books, collections of insects, &c., and hence are known as Book-lice.

PSORALÆA is a genus of the order LEGUMINOSÆ, and suborder Papilionacæ. The species are about 100 in number, found in the warmer parts of the world, especially in America and South Africa. They are either herbaceous plants or low shrubs, some of them ornamental, and all of easy culture. The flowers are blue, white, or purple, borne in short spikes or racemes; they are distinguished by their five-cleft, persistent calyx, its tube covered with glands. *Psoralea esculenta*, the Bread-root of North America, is cultivated along the banks of the Missouri and in other parts of that country. The tuberous roots abound in farinaceous matter, and are employed as food by the natives, especially during the winter months, both raw and boiled. In this climate it will grow in the open air, but requires the protection of a frame to produce abundant crops of roots. *Psoralea corylifolia* is diffused over every part of India, especially in the vicinity of villages, during the rainy and cold seasons. The pods have an aromatic taste, and are employed medicinally by the native doctors;

an oil is also obtained from them. In Chili an infusion of the leaves of *Psoralea glandulosa* is called Jesuit's Tea, and is esteemed as a vermifuge and stomachic; and an infusion of the root has emetic properties.

PSORIASIS. See LEPROA.

PSYCHE (Gr. *psychê*, the soul). Apuleius, in his "Golden Ass," is the first writer who relates the loves of Cupid and Psyche. According to his account, Psyche was the most lovely creature that the world ever beheld. People flocked from all parts to see her, and neglected the worship of Venus, who became in consequence so incensed against her that she commanded her son to inspire Psyche with love for some vile creature. Cupid, however, instead of obeying the commands of his mother, became enamoured with Psyche, and made her his wife. Of course the maiden, being a mortal, was not permitted to see the god in his real form, although, when sleeping, he assumed it. Psyche was tempted by the taunts of her sisters, envions of her unknown lover, to look at Cupid by the light of a lamp. A drop of oil fell on his beautiful shoulder, and he woke—but only at once to disappear from his untrusting wife. Inconsolable at her loss she wandered through the world in search of him, and after enduring many trials and sorrows at the hand of Venus, all which she bore with exemplary patience, was at length reunited to him. Jupiter conferred immortality upon her, and her union with Cupid took place with the approbation of Venus and the other deities. A child was soon afterwards born to them, who was called Pleasure. It appears that the story of Cupid and Psyche must have been current before the time of Apuleius, as there are works of art which represent this subject that were executed before he was born.

The above tale is a most complete and elegant allegory, representing the union between the divine love and the human soul. Further, the soul (*Psychê*) has, in Platonic parlance, an untroubled existence at first, followed by a stormy time of trial upon earth, and concluding with a period of bliss and immortality. The word *Psychê* signifies in Greek also a butterfly; because to the Greeks the butterfly emerging from the pupa-case typified the soul escaping from "this mortal coil." And the flame, so often fatal to the moth, is but too like the fire of love, which scorches the young soul and sometimes kills it outright. We frequently find in ancient works of art Cupid pressing Psyche to his bosom in the form of a butterfly.

PSYCHOLOGY (*i. e.* the science of soul or of mind). Psychology is a term used both in a wider and a narrower signification. In its wider meaning it comprehends the whole of philosophy proper, or reflective philosophy, thus dealing with the phenomena and the logical and ethical laws of personal consciousness or mind, and with external existence in its ultimate or metaphysical relations to these. In its narrower meaning psychology is an analysis of the phenomena of which we are personally conscious—with a physiological consideration of their organic conditions or accompaniments. This is now the commonly accepted view of the term.

Psychology, regarded as a preparatory analysis of the phenomena of which we are conscious, employs reflection as its appropriate organ of research, and its aim is to ascertain and describe accurately mental phenomena. Psychologists, for this purpose, are accustomed to study the various phenomena of man (*a*) as he is intelligent of objects—subjective or objective, ideal or real; (*b*) as freely or voluntarily determined towards ends, by motives which imply various sensibilities of pleasure and pain, and various corresponding tendencies to action. With the question of what the mind is, psychology has nothing to do; it seeks to investigate, not mind itself, but the phenomena of mind, or mental states. These we investigate in ourselves by introspection, and in others by observation.

(*a*) Psychological analysis seeks to detect the elements

implied in our consciousness or intelligence of objects, and the pure objects of which we are intelligent in external and internal sense. It distinguishes, in our actual matured intelligence, a power of representing or imagining what we have been thus conscious of—the representations being regulated by laws of mental association; and an active and personal power of elaborating, properly called thought, which implies a voluntary energy of attention and abstraction, operating by the help of signs, and affording occasions for error—thus opening the way for the metaphysical or ontological study of constructive reason.

(*b*) The psychology of man as voluntarily determined to certain ends by motives, comprehends an account of our various natural sensations and sensibilities, and our different appetites, desires, and affections, original or acquired, together with the phenomena of volition and moral agency. As objects of intelligence, all these may also be examined in connection with our internal consciousness; and practical or moral philosophy studies them as means of building up a virtuous character, or as temptations to vice against which we have to struggle.

The constitution of the human mind has been resolved by Kant, followed by Hamilton, into three ultimate elements—intellect or cognition, feeling or sensibility of pleasure or pain (comprising both the senses and the emotions), and conation or will—to one or other of which all the phenomena of consciousness are now commonly referred. It must be remembered, however, that although feelings and tendencies to overt action are necessarily dependent on consciousness, consciousness is not, in like manner, necessarily dependent upon them. It is the common condition of the passive or natural, and of the free or moral and spiritual element in man.

These psychological analyses of the phenomena of consciousness, whether with relation to their objects or their ends, are the preliminary part (or as most latter-day philosophers would say, the only valuable part) of metaphysics. A complete system of metaphysical thought should include this purification of our primary consciousness, in quest of the constructive elements implied in its development, and of the forces by which we are consciously moved to action; as well as that constructive interpretation of being in its ultimate or absolute relation to intelligence, in which metaphysics proper, or ontology, consists. It is evident, therefore, that psychology, though itself purely theoretic, has the most intensely practical results. For instance, it supplies the entire basis of education, the foundation of logic and rhetoric, the criterion of æsthetics, and the determination of ethics, with the allied arts of politics and legislation. See Professor Bain's great works, "The Senses and the Intellect" (1855), and "The Emotions and the Will" (1859), which have since passed through many editions; and also Herbert Spencer's "Psychology," two vols. (1870-72), and Professor Sully's excellent volume, "Outlines of Psychology" (1884).

PSYCHOMANCY (Gr. *psychomantis*, a necromancer). This was a species of divination, in which the spirits of the dead were summoned by certain spells, and made to reveal the secrets of the past and future. The modern spiritualism is a sort of travesty of this ancient superstition.

PSYCHOTRIA is a genus of plants belonging to the order RUBIACEÆ. About 500 species are known, consisting of shrubs found in tropical countries, especially in America. The flowers are white or yellowish, arranged in terminal panicles, and have a funnel-shaped corolla with a five-lobed limb. *Psychotria emetica*, a South American plant, furnishes striated *ipecauanha*, a substance possessing similar qualities to those of *ipecauanha*. *Psychotria uozia* is a native of Brazil, where it is accounted poisonous. *Psychotria speciosa* is employed in Brazil in the same diseases as *sarsaparilla*; and *Psychotria tinctoria* forms a fine red dye much valued in Peru.

PSYCHROMETER is a name often given to the wet-and-dry-bulb hygrometer.

PSYLLIDÆ is a family of insects belonging to the order Hemiptera, nearly allied to the Aphididæ, and like them known as Plant-lice. The Psyllidæ agree nearly with the aphides both in appearance and habits, but are distinguished by their long ten-jointed antennæ, short beak, and very large thorax; the femora of the short legs are thickened, enabling the insects to make powerful leaps. The Psyllidæ are minute insects, and live upon trees and plants, from which they derive their nutriment by suction, and in so doing they often produce excrescences somewhat resembling gall-nuts, particularly on their leaves and buds. The species are very numerous, each species being generally confined to a particular plant. *Psylla buxi* is very common in England on the box-tree. Other species occur on the apple, pear, birch, and other trees.

PTAH or **PETHAH** was the god in the ancient Egyptian mythology who represented the creative energy, what the Neo-Platonists of Alexandria called the *demiurge* (Gr. *demiourgos*), the world-maker. He was also compared by the Greeks to their own Hēphaistos (Lat. *Vulcan*); and elsewhere to Kronos, as the father or creator of the gods. The great seat of his worship was in Memphis, and he was adored as a mummy-shaped figure. Another representation of Ptah was as a pigmy.

PTARMIGAN (*Lagopus mutus*) is a species of Grouse (Tetraonine) inhabiting chiefly high mountainous regions in the north of Europe, Asia, and America. In Britain it occurs only in the north of Scotland, and there seems no foundation for the statement that it was formerly an inhabitant of the mountains of Cumberland and Wales. It is abundant in the Scandinavian peninsula, extending thence to Northern Russia and Arctic Siberia. It is also found on some of the higher peaks of the Alps and Pyrenees. The ptarmigan agrees with the Willow Grouse (*Lagopus albus*) and Red Grouse (*Lagopus scoticus*) in having the legs and feet densely clothed with feathers. The male bird is about 15 inches in length, the female being slightly smaller. In the summer the plumage of the male is ashy-brown, mottled with darker spots, and barred on the sides with orange and dark brown; the wings and under parts of the body are white, and the tail feathers are blackish, tipped with white. The plumage of the female is similar, but of a lighter colour on the upper parts. Early in autumn both sexes become ashy-gray on the back, and then are wonderfully assimilated in colour to the mosses and lichens abundant at that time of the year. Later on the whole plumage becomes a pure white, and so the bird is enabled to escape detection amid the surrounding snow. The ptarmigan flies tolerably swiftly and can run rapidly on the ground, but it trusts chiefly for concealment and safety to the similarity in colour of its plumage to the surroundings at the different seasons of the year. To such an extent is this protective resemblance carried that one may walk through a covey without discovering a single bird. Like the red grouse, but unlike most of the family, the ptarmigan is monogamous, pairing early in spring. The nest is a mere hollow in the ground, lined with grasses and feathers, and in it are deposited from eight to ten eggs of a yellowish-white colour, with dark brown spots and blotches. It feeds on leaves and twigs of species of heather and willow, seeds of various plants, and in autumn on berries. Its call-note is a low harsh croak.

PTERICAETHYS. See PLACODERM.

PTEROCARPUS is a genus of the order of LEGUMINOSÆ, containing many plants valuable for the nature of their products, and all of which are found indigenous in the tropical parts both of the Old and New World. The species are trees, often growing to a large size, with alternate pinnate leaves, and showy yellow flowers in racemes

or loose panicles. The pods are flat, roundish or oval, and contain from one to three seeds.

Pterocarpus dalbergioides is a native of the Andaman Islands, where it grows to an immense size, and forms a valuable timber tree, of which the wood is known as Andaman red wood, from its resemblance to mahogany; but it is redder, heavier, and coarser grained, though that of the root is finer than that of the stem. *Pterocarpus santalinus*, a native of India, yields the Red Sandal's Wood of commerce, a substance used in dyeing. The wood from the centre of the tree is imported in large billets, which, when fresh, are of a brilliant red colour, but which gradually deepens by exposure to air, so that the outside becomes blackish coloured. It is insipid, inodorous, and takes a fine polish. It yields its colour readily to alcohol, very slowly to water. It furnishes a permanent dye.

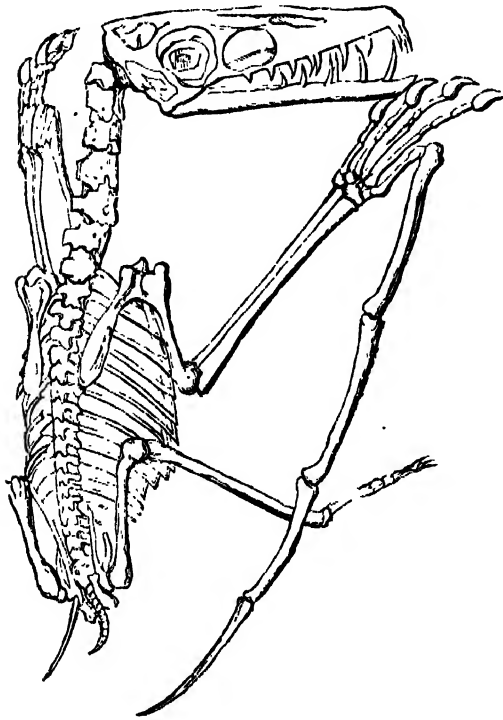
Many of these trees exude a reddish-coloured juice which hardens into a kind of astringent gum. The name of Dragon's Blood has been applied to that from *Pterocarpus draco*, a native of South America and the West India Islands, as well as to the similar product of several other trees, while that of *Pterocarpus erinaceus* (the African rosewood) is the juice known as Kino on the west coast of Africa.

Pterocarpus marsupium is another species, a native of the Circar Mountains of Hindustan, and grows to a large tree. It also exudes a red juice, which hardens into a strong simply astringent gum of a dark red colour, used medicinally and also in dyeing and tanning. See KINO.

PTERODACTYLE is the general name of some remarkable flying reptiles which existed during the Secondary epoch in Europe and North America; they constitute a distinct order, Pterosauria, of the class Reptilia. Like birds and bats, the pterodactyles possessed the power of flying, but the organ of flight was differently constructed from that of either of these groups of aerial vertebrates. The outermost digit of the hand is enormously elongated, and supported an expanded membrane, which extended along the forearm and the flanks of the body, reaching down the sides of the hind limbs as far as the ankle, and including the tail. The sternum or breast-bone is large and broad, and provided, as in birds and bats, with a short broad keel to give attachment to the powerful pectoral muscles necessary in flight. The pterodactyles further agreed with birds, and differed from bats, in having most of the bones hollow and filled with air, an arrangement of importance in reducing the specific gravity of the body. The pectoral arch supporting the fore limb is bird-like, consisting of a long slender scapula and a distinct coracoid; clavicles do not seem to have been present. The hand has four digits, the first three being provided with claws, and the fourth, which supports the wings, being clawless; the first digit has two phalanges, the second three, and the third and fourth four. In the foot there are five digits, the first four having sharp claws, while the fifth is, in some species, rudimentary, and in others long and attached to the wing. The head is elongated, with a very large orbit and an enormous gape; it is rendered light by the occurrence of spaces in the skull, a very large one being placed between the orbit and the nasal orifice. From the position of the articulation of the skull and vertebral column, it is evident that these reptiles, when on the ground, could stand upright on their hind feet. In the typical species the jaws are armed with long slender teeth, lodged in distinct sockets, but in others the front portion of the jaws is without teeth, and probably was protected by a horny beak; in the North American forms, from the Chalk, there are no teeth present. The sclerotic of the eye was protected by a ring of bony plates. The vertebrae of the neck are large and strong, and without ribs. The dorsal vertebrae are *procoelous*, that is, concave in front, convex behind. Ribs reaching down to the sternum

were present. The sacrum consists of from three to six vertebrae. The pelvis and the hind limb are small. The tail is usually short. The body was probably smooth, or protected by scales.

The pterodactyles are, for the most part, of small size, but some species from the Chalk probably had an expanse of wing fully 20 feet. They lived upon insects, the larger



Skeleton of *Pterodactylus Crassirostris*.

species also probably feeding upon fishes and small reptiles. They are entirely confined to the Secondary epoch, ranging from the Lower Lias to the Middle Chalk; the lithographic slates of Solenhofen (Upper Oolites) are particularly rich in these reptiles.

The typical genus *Pterodactylus* contains species from a foot to 16 inches long; several species have been found in the Stonesfield slates and Wealden of England. In another genus, *Dimorphodon*, found only in the Lias, the front teeth are large and pointed, the hinder small and lancet-shaped. The genus *Rhamphorhynchus* is distinguished by its very long tail, and by the place of teeth in the front of the jaws being supplied by a horny beak; it is confined to the Jurassic rocks. *Pteranodon* is a genus constituted by Professor Marsh for some gigantic forms from the Chalk of North America, in which the jaws are totally devoid of teeth, but probably ensheathed in horn. Another genus, *Ornithopterus*, from the Bavarian lithographic slates, differed from all the preceding in having only two phalanges in the elongated digit which supports the wing.

PTEROPODA is a class of **MOLLUSCA**, forming a connecting link between the **GASTEROPODA** and the **CERPHALOPODA**. The mid-foot is expanded into a pair of large muscular lobes which form wing-like fins, by means of which the animal makes its way through the water. The head is not sharply defined, and is embraced by the rudimentary fore foot. The hind foot is usually aborted,

but sometimes it is distinct, and supports an operculum. The mouth is small, and is sometimes surrounded by one or more pairs of tentacles, which, in *Pneumodermion*, are beset with suckers. These tentacles are probably to be regarded as processes of the fore foot. The mouth, which is provided with a lingual ribbon bearing teeth, leads into a long oesophagus, which is followed by a dilated stomach and a long intestine, amid the coils of which is the liver. The anus is placed on the right side near the anterior end of the body. The body is usually elongated and straight, either without a shell or mantle or with a shell, which is generally symmetrical, delicate, and translucent. Respiration is performed either by the general integument or by the wall of the extensive mantle-cavity where the mantle is present. The kidney is an elongated contractile sac opening either into the mantle-cavity or to the exterior direct. There is a heart, consisting of an auricle and a ventricle. Sense-organs are not well developed. Auditory organs, in the shape of otocysts, are present, but eyes occur in only a few forms, and then are mere pigment spots. The sexes are united in the same individual.

The pteropods are found in immense numbers in the open sea both in the tropics and in northern regions. They are all of small size, the largest not being more than about an inch in length, and are frequently gaily coloured. Swarms of them are often to be seen swimming at the surface of the water. In arctic seas they form the principal food of the Greenland whale, and are also preyed upon by many sea-birds. The pteropods themselves feed on minute crustaceans, &c. The recent species are few, and the fossil were not much more numerous.

The class *Pteropoda* is divided into two orders. The *Therapsomata* have the hinder part of the body protected by a delicate shell, which in one family (*Limacnidae*) is spirally twisted. A mantle is also present, and the walls of the mantle-cavity are ciliated, and have a branchial function. This order contains the families *Hyalidae*, *Cymbulidae*, and *Limacnidae*. Some fossil forms from Palaeozoic rocks are referred to this order, some of which (*Conularia*) reached the comparatively gigantic length of two feet. Species of the genus *Styliola* abound in the Atlantic, and are sometimes found on British coasts. The shells of pteropods of this order are also found in great abundance in the *Globigerina* ooze which covers the bed of the Atlantic.

The order *Gymnosomata* contains forms with neither mantle nor shell; the head bears tentacles which in some cases are beset with suckers. The species *Clione borealis* occurs in enormous numbers in arctic seas, and forms a considerable item in the food of the Greenland whale. The genus *Pneumodermion* has small branchial processes at the posterior extremity of the body. In this order there is a peculiar larval form with three rows of cilia round the body.

PTOLEMAIC SYSTEM. A few words of general explanation are all that can be given under this head, as we are not now speaking with particular reference to Ptolemy, but of the astronomical part of that system which, founded on early metaphysical and physical doctrines adopted by Plato and Aristotle, reinforced by mathematical hypotheses drawn from Hipparchus and Ptolemy, received by the Mohammedans, and by them imparted to the Christians of the middle ages, was the doctrine universally established in Europe till the seventeenth century. As a whole it combines the physics of the Aristotelian school, the geometry of Euclid and his successors, the sexagesimal arithmetic of the Greeks, and the astronomy of Hipparchus and Ptolemy, with some slight additions from later names. The geometry remains; the arithmetic has been supplanted by the decimal system of the Hindus; the physics and astronomy stood and fell together; and as under the words "Ptolemaic System" the astronomy is par-

ticularly meant, we only notice the physical notions connected with it.

The early separation of perceptible matter into the four elements of earth, water, air, and fire, with observation of the relative places they appear to assume, led to the formation of an elementary system. Earth (and solids generally) sink in water, while air rises in water, and flame in air. Hence the notion that the mass of the earth is the central body of the universe; above is a region of water, through which rises that portion of earth on which men and animals live. Above this is a region of air, and above this again a region of fire. Nothing is at rest until it arrives at its proper or natural place, and all the motions of a part separated from its whole are rectilinear; fire rises, and bodies fall in straight lines. Gravity and levity are only the efforts of bodies separated from their natural places to return to them.

Above the earth and the elementary zones which encompass it are other successive zones, called heavens. Each heaven contains an immense crystal spherical surface, to which one of the heavenly luminaries is attached, or would be attached, if it moved uniformly in a circle, as it would then do if the crystal sphere were made to revolve uniformly. But the varied motions of the heavenly bodies made it necessary that smaller orbs should be placed with their centres upon the larger ones, and that the planets should move with the smaller ones. It is hardly to be believed that Ptolemy and the mathematicians received these orbs in the physical sense, or as anything but an hypothesis for representing the actual motions of the planets. It is certain, however, that the actual solid orbs continued to be believed in till a late period.

The first heaven is that of the moon; the second, that of Mercury; the third, that of Venus; the fourth, that of the Sun; the fifth, that of Mars; the sixth, that of Jupiter; the seventh, that of Saturn; the eighth, that of all the fixed stars. The heavens of Aristotle end here. Later theorists add two more—a ninth, to make the precession of the equinoxes, and a tenth, or primum mobile, to make the diurnal revolution. All beyond this is the empyreal heaven.

The office of the primum mobile is to revolve from east to west in twenty-four hours, carrying with it (but how we do not know) the whole of the subordinate heavens, and making all the phenomena of day and night. All the heavenly motions are to be circular and uniform. This doctrine of the Platonic school is the keystone of the whole system. The poles of the primum mobile are those of the equator; but the ninth heaven moves slowly round the poles of the ecliptic, carrying the whole system forward in longitude, so as to give the phenomena arising from the precession of the equinoxes. The heavens of the other heavenly bodies move round with the mean motions of the bodies depending upon them, and this completes the general view of the system.

The details of the heavenly motions were for the mathematicians only, who dropped the orbs, and only took such circles out of them as were necessary in the explanation of the motions.

Ptolemy succeeds in giving a tolerable account of the angular motions known in his time, but he fails in placing any planet at the right distance from the earth, though he may place it nearly in the right longitude.

PTOLEMY (CLAUDIUS PTOLEMAIOS), a native of Egypt, lived at Alexandria in the first half of the second century of our era, in the reigns of Hadrian and Antoninus Pius. He was observing (as an astronomer) in 139, and was still alive in 161. Nothing more is known of his life except his works. He was also a chronologist and geographer.

His geography was for many centuries the text-book in that science for all the schools, and was superseded only in the fifteenth century, in consequence of new information

derived from the discoveries of the Venetian, Portuguese, and other travellers and navigators. Ptolemy and Strabo followed a different method in their respective works. Strabo's work is a descriptive, that of Ptolemy is a mathematical geography. Ptolemy applies himself to fix the astronomical position of each place; he gives a bare list of names of mountains, rivers, and towns, with their respective longitude and latitude, without any description, or at least only a few words. He fixes the position of each place as if it were ascertained by astronomical observation. He availed himself of the labours of Eratosthenes, Hipparchos, and the other mathematicians of the Alexandrine school; but by adopting the method of Hipparchos in the projection of the map, he committed a material error in his longitudes, as his measurement of the world from east to west is far too great. Many of Ptolemy's maps are still extant and are exceedingly curious.

A good view of the Ptolemaic world, reduced to its real extent and position, is given by Gosselin, in a map at the end of the fourth volume of his "*Recherches sur la Géographie Systématique et Positive des Anciens, pour servir de Base à l'Histoire de la Géographie Ancienne.*"

The latter part of book seven and book eight of Ptolemy are a recapitulation of his system, with a description of the maps, twenty-six in number, which accompanied the work; namely, ten for Europe, four for Africa, and twelve for Asia. Several editions of his geography, translated into Latin, appeared in the fifteenth century. The best is that of Louvain in the Netherlands (1619). The Abbé Halma published at Paris (1828) the first book of Ptolemy in the Greek text, with a French translation, accompanied by a memoir "*On the Measures of the Ancients.*"

As an astronomer Ptolemy is known by the famous **PTOLEMAIC SYSTEM**, which is embodied in the "*Ahmad-gest*," the Arabian composite name for his "*great treatise on astronomy*" (Arabic *almagest*; Gr. *megistos*, greatest), Ptolemy's own name for the work being "*Mathematikê Syntaxis*." The "*Syntaxis*" contains nearly all that is known respecting the ancient astronomy. It is divided into thirteen books. In the first book the author treats of the figure of the earth, which he demonstrates to be spherical, the obliquity of the ecliptic, and other fundamental elements. The second book is devoted to an investigation of the length of the day, and the position of the ecliptic with respect to the horizon in different latitudes. In book third the tropical and sidereal years are discussed, and the elements of the solar orbit are investigated. In this book Ptolemy gives a clear exposition of the circumstances upon which the equation of time depends. It is a curious fact that subsequent astronomers continued notwithstanding to form an erroneous conception of the equation of time, until Flamsteed again explained its real nature. Books fourth and fifth are devoted to the moon. In the latter of these two books the author gives an account of his discovery of the inequality of the moon's longitude, to which modern astronomers have applied the name of *erection*. In the earlier stages of astronomy the moon's position in the celestial sphere was determined solely during the occurrence of eclipses, on which occasions the inequality of the erection vanishes, or rather is confounded with the principal inequality in longitude depending on the eccentricity of the lunar orbit. But when Ptolemy proceeded to observe the moon in quadratures with an instrument constructed for that purpose, he encountered a series of irregularities in the moon's longitude which he was unable to account for by the principal inequality, the magnitude of which had been already determined by Hipparchos; and in this way he was led to his important discovery of the erection, an achievement which would alone suffice to secure for him a place among the great astronomers of all time. The sixth book of the

"Syntaxis" is devoted to the subject of eclipses. Books seventh and eighth treat of the stars and the Milky Way. The former of these books contains a catalogue exhibiting the longitudes and latitudes of 1022 stars. The remainder of the work is devoted to the theory of the planets, which Ptolemy had the merit of first establishing upon the principles of the epicyclic theory. In the "Syntaxis" the earth is supposed to be placed immovable in the centre of the universe, while the heavenly bodies really revolve around it in the manner indicated by their apparent motions. This arrangement of the great bodies of the universe was termed in consequence the Ptolemaic system, although it is in reality of much higher antiquity than the time of Ptolemy. It may be mentioned that a beautiful Greek and French edition of the "Syntaxis" was published by Palma at Paris in 1813. Ptolemy also published works on chronology, and reorganized the system of Greek music, lowering all the scales which had become too high for the voice, altering the tuning of the tetrachord, &c. In fact, and in spite of his mistake in overriding the Pythagorean true teaching of astronomical facts, Ptolemy must be admitted to be one of the greatest physicists of all antiquity.

PTOLEMY I. (Gr. *Ptolemaios*), *Ptolemy the Great* or *Ptolemy Sôter* (Preserver), the founder of the dynasty of Greek kings in Egypt, frequently called the Lagidae, was one of the ablest of the generals of Alexander the Great. He was, in fact, the half brother of Alexander, being the illegitimate son of Philip of Macedon. In the division of the provinces, on the death of Alexander, B.C. 323, Egypt was assigned to him, and he erected it into an independent kingdom. He also added Kurênû (Cyrene) and the surrounding country to his dominions. The defeat of Perdikkas, who invaded Egypt B.C. 321, and the subsequent defeat of Antigonus at the battle of Ipsos, B.C. 301, secured him in their quiet possession. His surname of Sôter, the Preserver, was gained by his timely assistance to the island of Rhodes, which enabled the Rhodians to throw off Demetrios, son of Antigonus, who was pressing them hard with a siege.

The remainder of his reign was devoted to improving the condition of his kingdom. The city of Alexandria, founded by Alexander, became the first commercial city in the world and the entrepôt of Indian products. Ptolemy respected the religion of his Egyptian subjects, and contributed to the restoration of the ancient monuments of the country. Many Jews settled in his dominions, and were allowed to have their synagogues. This king and his successors adopted certain Egyptian customs and religious practices, which they seem to have intended to unite as much as possible with the religion of the Greeks.

Ptolemy I. was a patron of learned men, and was himself an author. He wrote a history of the wars of Alexander, which partly supplied Arrian with the materials for his history. He invited learned Greeks to Egypt, without any distinction of religions or philosophical opinions, and he laid the foundation of the school of Alexandria, by establishing the famous museum and library. Euclid (Eukleidês), the famous geometer, wrote under him. Ptolemy assumed the title of king B.C. 306. He died B.C. 283, at the age of eighty-four. He was the most sagacious man of his age. His choice of the most distant and apparently undesirable province (B.C. 323) enabled him to avoid many quarrels and to consolidate his power. Of all the great Alexandrian generals he alone founded a durable kingdom.

PTOLEMY II., surnamed *Philadelphos* (i.e. the Brother-loving), succeeded his father, B.C. 283. The reason of this surname is very hard to imagine, since Ptolemy Philadelphos was quarrelling with his brother all his life. He followed the example of his father in the encouragement of learning, and he maintained with great liberality many

distinguished philosophers and poets, of whom the most celebrated were Theokritos, Lukophrôn, and Kallimachos. He completed the public library commenced by his father, and also the museum for the promotion of learning and the support of learned men. The museum contained, among other compartments, a public theatre or lecture-room, and a hall where the learned and those who belonged to the museum dined together. Attached to the museum there were botanical and zoological gardens. The institution was enlarged by the Roman Emperor Claudius three centuries later.

Ptolemy Philadelphos showed the same favour to the Jews as his father had done, and it was under his auspices that the Hebrew Bible was translated into Greek (Septuagint). His resources were very great. He is said to have left £200,000,000 sterling. Much of the wealth which he acquired was, without doubt, owing to his monopoly of the trade with India and other parts of Eastern Asia. He also used every effort to extend the trade of Alexandria; he obtained possession of the Soudan, the maritime parts of Arabia, and of the eastern coast of Africa, and his admiral, Timosthenês, appears to have gone as far south as Madagascar. He opened the ancient (Sweet Water) canal of the Pharaohs, and connected the Red Sea with the Mediterranean. He maintained an army of 200,000 men, besides 40,000 horse, and an immense fleet. He died B.C. 247. His first wife was Arsinoë, the daughter of Lysimachos; and his second, his own sister Arsinoë. His marriage with his own sister was contrary to Greek, but in accordance with the royal Egyptian usage.

PTOLEMY III., surnamed *Euergetês* (the Benefactor), succeeded his father B.C. 247. Under this king the greatest extent and splendour of the kingdom, so far as the Ptolemies were concerned, was attained. He was engaged in war at the commencement of his reign with Selenkos Kallinikos, to revenge the death of his sister Berenikê; and he obtained possession of many of the provinces belonging to the Seleucidae.

Ptolemy the Benefactor obtained his surname by bringing back from this campaign the statues of some 2500 gods which the mad Cambyzes had carried away from Egyptian temples. He followed his father's example in giving every encouragement to trade and commerce. It appears, from an inscription which was found at Adule by Cosmas, that Ptolemy had conquered Abyssinia, and that he maintained a powerful fleet in the Red Sea.

During the reign of Euergetês, Kleomenês, king of Sparta, took refuge in Egypt, and was received by him with great distinction. Ptolemy III. died B.C. 222.

PTOLEMY IV. Three great kings in succession, respectively the wisest, the most wealthy and cultured, and the most splendid princes of their time, was a strain too great for any family. Consequently Ptolemy IV., called the Father-lover (*Philopatôr*), shows a rapid falling off. The reason of his surname is obscure, for his relations with his father were so strained that many persons accused him of poisoning him. Some authorities go so far as to suggest that the name was given him in horrible irony.

Ptolemy Philopatôr began his reign with deeds of blood, 222 B.C., by murdering his mother Berenikê, his brother Magas, and his uncle Lysimachos. Sosibios was his minister and councillor, a man little better than his master, and unfitted to conduct the affairs of a great kingdom. Antiochos the Great, king of Syria, took advantage of the



Coin of Ptolemy Euergetes in British Museum—actual size (silver).

indolence of the monarch to invade Egypt. By the exertions of Arsinoë, sister and wife of Philopator, an army was collected and, along with a fleet, sent against Antiochos; but the army was conquered, and Palestine, with a great part of Coele-Syria, fell into the hands of the Syrian king, 218 B.C. In 217 B.C. Ptolemy marched at the head of a large army against Antiochos, and defeated him at Raphia with great loss. After peace was concluded between the two sovereigns, Ptolemy returned home by way of Jerusalem, where his curiosity was excited by the reverence paid by the Jews to their Holy of Holies. Only by main force did the Jewish priests prevent what in their eyes was an abominable crime, for the sensual Philopator insisted upon trying to make his way through the sacred veil. In consequence of this the king became afterwards the bitter enemy of the Jews, both in their own land and in Alexandria. The campaign, with its results as concerns the Jews, is very vigorously depicted in Daniel xi., and in the third book of Maccabees. Some time after his return he murdered his queen, Arsinoë. His own death took place 205 B.C. The character of Philopator is that of a weak and indolent sensualist, who cared little for public affairs. Yet he was a patron and admirer of men of letters, philosophers, and poets.

PTOLEMY V., surnamed *Epiphanês*, i.e. the Illustrious (for no conceivable reason), was only five years old at the death of his father, Ptolemy IV. The decay of the kingdom under that sensualist had ended in disastrous weakness. Rival Greek kings fell upon it, and all the outlying provinces were lost, Cyprus and Cyrene (Κυρηνê) alone remaining beyond Egypt itself. The Jews from the conquered provinces mustered at Alexandria in great numbers, and since Jerusalem was now in the hands of the King of Syria, Onias, high priest, founded the city of Leontopolis as the Jewish holy city. In the distress of the impoverished kingdom the boy-king's advisers bethought themselves of the ancient alliance between Ptolemy Philadelphos and Rome, and begged the great city's help. This was at once granted, and thus began the Roman influence in Egypt, which in about a century and a half ended in its becoming a Roman province. M. Aemilius Lepidus came out as legate, and Antiochos, king of Syria, was ordered to give his daughter Cleopatra (Κλεοπάτρα) to the young Ptolemy and restore Phœnicia and Coele-Syria. In Daniel xi. we read, "Many stood up against the king of the south . . . and the arms of the south did not withstand." Eventually "he (i.e. Syria) gave him (i.e. Egypt) a young maiden," doubtless hoping she would help him to keep some hold of the lost provinces, but as the prophet quietly remarks, "she did not stand on his side." In fact, the Syrian Cleopatra became a zealous Egyptian and supporter of the Roman alliance. She was urging her husband to enforce the retarded delivery of the provinces when he was poisoned B.C. 181. At the coronation of Epiphanês, in B.C. 196, many royal messages were sent out, and these were loyally replied to. One of such replies, engraved on a piece of black basalt, 3 feet 7 inches by 2 feet 6 inches, in three languages and styles (Greek, Egyptian hieroglyphic, and Demotic), was discovered at Rosetta during the French occupation of Egypt in 1799. Hence it is called the Rosetta stone. It fell into the hands of the English when they drove the French out of Egypt, and is now one of the chief treasures of the British Museum. Its enormous interest lies in the fact that by help of the three identical inscriptions the long-lost secret of the hieroglyphics was discovered.

PTOLEMY VI. (*Philomêtôr*, or Mother-lover, because of his acquiescence in the regency of his mother Cleopatra of Syria) was the eldest son of Ptolemy V. On Cleopatra's decease in 173 B.C. the country fell into a war with Antiochos Epiphanês of Syria, with the view of recovering the provinces of Coele-Syria and Phœnicia. Antiochos

defeated the Egyptian army, 170 B.C., and Philomêtôr himself fell into the hands of the victor, who treated him with distinction. His younger brother, nicknamed *Phuskôn* (Big-belly), who was then at Alexandria with Cleopatra his sister, hearing that Philomêtôr was a prisoner, assumed the title of king under the name Euergetês II. Having established Philomêtôr at Memphis, the Syrians returned to their own country. After this the young king proposed peace between himself and his brother. It was agreed that they should reign jointly, Philomêtôr marrying his sister Cleopatra. The report of this junction led Antiochos to march again into Egypt. When he had got before the walls of Alexandria a Roman embassy commanded him to desist (168 B.C.). The union of the brothers was not of long duration. The "Big-bellied one" expelled Philomêtôr from Alexandria. The latter then appealed to the Romans, who reinstated him in the sovereignty, and gave Cyrene to Phuskôn. But the restless ambition of the younger brother prompted him to intrigue at Rome, where he got a promise of Cyprus being added to his dominions. His negotiations came to nothing, because Philomêtôr was beforehand in having both a fleet and an army in the island, and defeated his brother, who fell into his power, but was again pardoned on condition that he should keep himself within Cyrene. Ptolemy VI. was the last really capable ruler of the dynasty. He was completely successful in a second Syrian campaign, but fearing the jealousy of Rome, set up a Syrian king there instead of retaining the province himself. In the course of the troubles arising out of this he died through a fall from his horse, 146 B.C.

PTOLEMY VII. (*Euergetês II.* or *Phuskôn*). During the imprisonment of his brother he had for a time occupied the throne, and on the death of Ptolemy VI. he murdered his son and seized the throne, forcing the mother of the boy he had murdered to marry him. His cruelty and oppression rendered him so odious that he had to flee from Egypt, though he afterwards returned. He died 117 B.C.

PTOLEMY VIII. (*Sôtêr II.* or *Lathouras*) was the eldest son of Ptolemy Phuskôn by Cleopatra, daughter of the first Cleopatra, his sister and first wife. His mother had been appointed to succeed to the throne, and wished to have the younger son, Ptolemy Alexander, co-regent. She was compelled, however, by popular feeling to take Lathouras instead. After reigning together not very harmoniously for several years an insurrection was excited at Alexandria against the son, whom the mother accused of a design upon her life. He fled to Cyprus and established himself there, while she ruled in Egypt with her favourite son Alexander as Ptolemy IX. When Cleopatra died Alexander was expelled from Egypt 89 B.C., and Lathouras was recalled and reigned over Egypt till his death in 81 B.C. He had been absent eighteen years. Ptolemy VIII. seems to have been a king of mild and humane disposition. He was not energetic, bold, nor warlike, but he was just and upright.

PTOLEMY X. (*Alexandros II.*) was the son of Ptolemy IX. Ptolemy Lathouras had left only an illegitimate son, who was a music-lover, and was nicknamed *Anûktês*, the Flute-player. Curious though Egyptian royal marriages were, yet they were as respected as our own customs, and illegitimacy was as disgraceful as with ourselves. Alexander therefore succeeded, having gained the favour of the all-powerful Sulla, dictator of Rome. But meanwhile Berenikê, daughter of the late king, had been crowned by the people. Alexandros therefore married his cousin and so appeased the people. As soon as he was crowned and supported by Roman arms, however, he put her to death. Enraged at this the Alexandrians rose in revolt and murdered him. But by so doing they had destroyed the last legitimate descendant of Ptolemy the Great.

PTOLEMY XI. (Dionusos, the Flute-player, *Aulétes*), therefore, though illegitimate, stood forth as the son of Ptolemy VIII. (Lathouros), and was very quickly accepted as king. But Alexandros had left Egypt by will to the Roman people, and it took the Flute-player twenty years of incessant bribery to get the Roman Senate to acknowledge his title. And when they did so, then the popular leaders extorted £1,500,000 before the people of Rome would ratify the decree of the Senate. But in paying his last crushing tribute Ptolemy had ruined the country he sought to reign over. In one short year after he was admitted by Rome to uncontested kingship, he was thrust out by his own overtaxed, maldenied, and half-starving subjects (B.C. 58). He fled to Rome, where his ill-gotten gold had raised him hosts of friends among the rapacious nobles. The Senate eagerly promised to restore their friend to power, and winked at the bastard's murder of all the Alexandrian envoys who had come to Rome to plead the cause of Egypt. But the tribunes of the people learned the crime, and so lashed the Senate and their protégé with scathing oratory that the first ceased to support, and the second slunk away to Ephesos in Asia. There he offered a Roman soldier of fortune £2,500,000 if he would restore him to the throne of Egypt. Pompey the Great was then all-powerful in the Roman state, and agreed to the attempt being made. The irresistible legions moved forward, and Egypt was once more ruled by the Flute-player. His first act was to murder his daughter Bereniké, who had been elected queen. He was supported by the Roman spears till he died in B.C. 51.

PTOLEMY XII. and XIII. Ptolemy XI. left two sons (both Ptolemies) and two daughters, one of whom was the famous Cleopatra, the "serpent of Old Nile." By the will of the Flute-player, Cleopatra was crowned joint sovereign with her eldest brother, who was styled Ptolemy XII. She was sixteen, and he was ten, but they were nominally married on their accession. In B.C. 48 a quarrel drove Cleopatra from the throne and the kingdom. At the moment of her return, at the head of a Syrian army, and while the two armies stood face to face before the battle, Pompey the Great arrived, flying from before Cæsar. Ptolemy XII. feared that if he received Pompey he should incur the enmity of Cæsar, whom he recognized as the greater power. He therefore caused Pompey to be assassinated as he stepped on shore. Cæsar arrived almost at once, adopted Cleopatra's side, and after great vicissitudes [see CÆSAR] utterly defeated Ptolemy. In the rout men crowded the Egyptian king's boat, so that it sank and he was drowned. Cæsar married Cleopatra to her younger brother, with the style of Ptolemy XIII., and saw them safely on the throne before he left Egypt. Cleopatra afterwards followed Cæsar to Rome to renew a companionship he had once found delightful, and thereby to gain the sovereignty of the East, but she found Cæsar careless of her fascinations, and returned in despair to Alexandria. One of her first acts was to put to death her boy-brother-husband. The brief remainder of the history of Egypt under the Greek sovereignty of the Ptolemies is told in the articles EGYPT and CLEOPATRA.

PTO'SIS is a dropping of the upper eyelid, which the patient cannot by any voluntary exertion raise from before the globe of the eye. In some cases this effect is produced by great inflammatory swelling of the eyelid, with effusion of serum into its tissue; but in those cases to which the

ptyalin are its very small quantity compared with the bulk of the saliva, its close dependence upon temperature for its activity, a high temperature destroying it altogether, and its permanence—that is, its not wasting away or being used up or changed, while itself effecting large changes in starchy bodies, which it converts to sugar. The action of ptyalin is favoured by a slightly alkaline medium; a decidedly acid medium quite checks it. It is destroyed by acids and by strong alkalis.

PUBLIC SAFETY, COMMITTEE OF, in the French Revolution, a body selected from, and appointed by, the French National Convention, 6th April, 1793, with powers to provide for the general well-being of the Republic. It was, in fact, invested with dictatorial authority, and after the fall of the Girondists, 4th December, 1793, became the actual government of France. On the introduction of the new constitution of October, 1791, it was dissolved, after a career of bloodshed, violence, and rapine. "To stand at no obstacles, to heed no considerations, human or divine, to know well that, of divine or human, there is one thing needful, triumph of the Republic, destruction of the enemies of the Republic," were, in Carlyle's words, its leading principles.

PUBLIC-HOUSE SIGNS. See SIGNS.

PUBLICAN. The *publicani* of the ancient Roman state were a body of persons who farmed the public revenues, from which circumstance the name appears to be derived. The Roman senate, as early at least as the Second Punic War, adopted the system of farming the direct taxes (*vectigalia*) and the customs (*portoria*) to capitalists who undertook to pay a given sum into the treasury, and who recouped themselves by collecting the taxes assessed by the law. Soon afterwards the practice was extended to all tolls, tithes, harbour dues, duties for the use of mines and salt works, and to the *scriptura* or the tax paid for the use of the public pasture lands. Contracts of this kind fell naturally into the hands of the *equites* as the richest class of Romans. In the majority of cases the amount to be paid was beyond the means of individual capitalists, and a joint-stock company (*societas*) was formed with one of the partners (*maneps*), who was responsible to the government, resident at Rome, and with representatives (*magistri*) in the provinces. Under the *magistri* were their deputies, *submagistri*, and these employed in their turn the *portitores*, who acted as custom-house officers, &c., and who were generally natives of the province or district.

Although convenient for the central government, the system of farming the revenue was essentially vicious, and it led to an enormous amount of extortion and cruelty. At Rome the *publicani* were a powerful class who supported each other in demanding severe laws for their protection from the state, and who fiercely resented all interference. Their agents were encouraged to get all the profit they could for the company without any undue regard for the letter of the law, and many of them seem to have done a little business on their own account in addition. They overcharged with impunity, imposed vexatious fines, brought false charges of smuggling against those who would not pay hush-money, and the injured persons found it all but impossible to obtain any redress. In the Synoptic Gospels the term publican is used exclusively for the *portitores*, and we find these persons are usually mentioned together with "sinners." Feared and disliked everywhere, these men were regarded with burning hatred by the Jews, who looked on them as traitors and apostates as well as extortioners, and as far as was possible they were socially excommunicated in Judea. "Eat not their bread, take not their alms, receive not their word in court," was the saying current at the period of Jesus, and it was maintained that a promise made to a publican was not more binding than one made to a thief or murderer. Considered

*** **PTALIN** (Gr. *ptaloun*, saliva), an animal ferment which is supposed to belong to saliva. It is said to be analogous to the vegetable substance termed *diastase*, and as it converts starch into glucose and dextrin, has been designated *salivary diastase*. The salient peculiarities of

as outside the true fold and worse than the heathen by their countrymen, we find these men formed some of the first converts of John the Baptist and of Jesus, and that one of the apostles of the latter, the evangelist Matthew, was drawn from among the publicans. The attitude of Jesus towards this despised class seems to have aroused against him the hostility of the Pharisees, and the taunting phrase, "a friend of publicans," occurs more than once in the Synoptics, while the feeling of the Master is most vividly portrayed in the well-known parable of the "Pharisee and the Publican."

PUBLICOLA ("beloved of the people"), a name given to P. Valerius, who was the colleague of Brutus in the first consulship of the newly-made republic of Rome after the expulsion of the Tarquins, in which revolution he had borne a great part (B.C. 509). He was a thorough democrat, always on the watch against the foundation of any power which might become arbitrary and replace the kings. The consuls were attended by lictors bearing axes, but he ordered them to lower the axes before the people in token of the sovereignty of the latter. He founded the right of appeal to the people from a sentence of a magistrate, and in other ways so gained the affection of the people that when he died (B.C. 503), after having been consul four times, he was buried at the public expense, and the public mourning for him lasted ten months. How great a contrast between Publicola at the beginning and Sulla or Marius at the close of the republic!

PUCCINIA. See *ÆCIDIIUM*.

PUCK (perhaps from the Slavonic *bog*, deity, and connected with the English *boggy* and *bugbear*, but more probably a purely Celtic word, the Irish *púca*, sprite), an imaginary personage of mischievous character introduced into mediæval mythology, and variously known as Robin Goodfellow, Friar Rusli, Lutin (in France), and Knecht Ruprecht (in Germany). In Shakspeare's "Midsummer Night's Dream" he plays an important part in connection with the fairy court of Oberon and Titania. On the whole he was well-disposed to human beings, and was tricky rather than malignant.

PUD DINGSTONE is a vernacular name applied to the rock more scientifically termed *CONGLOMERATE*. The two terms are now practically synonymous, but the first was originally given to the peculiar Eocene conglomerate of Hertfordshire, in which innumerable black flint pebbles are cemented together in a light-coloured matrix, thus giving the stone a fanciful resemblance to plum-pudding.

PUEB'LA, a city of Mexico, and the capital of a state of the same name, situated in a healthy situation on a table-land 7500 feet above the sea, 70 miles E.S.E. of Mexico. It is regularly built and well paved, with handsome squares and houses of stone, many with iron balconies and painted fronts; a magnificent cathedral, and numerous churches, monasteries, nunneries, and collegiate houses. In fact, the town is chiefly famous for the number and splendour of its ecclesiastical foundations. Indians and the female part of the population receive the tale with implicit faith, that during the erection of the cathedral angels made their appearance every night and carried on the building. Hence the name of the town, which in full is *La Puebla de los Angeles*, the town of the angels. An extensive trade is carried on—glass, earthenware, and soap being the principal manufactures. A railway was opened to the city of Mexico in 1869. In the vicinity are large gardens and mineral springs. It was bombarded for four days by the French in 1863. The population is about 70,000.

PUER'PERAL FEVER is the name given to a continued fever occurring in connection with childbirth, the proximate cause of which is the absorption of septic matter, either introduced by contagion or developed through the retention of portions of the placenta or membrane. The ab-

sorption of the poison is an essential feature of this disease, but the symptoms display very great variety, depending as they do on the localities attacked and the violence of the fever. In most cases the fever originates within three or four days after delivery, and it is ushered in by great depression and headache, and perhaps a fit of shivering. The temperature rises to 103° Fahr., or even beyond, the skin becoming hot and dry, and the pulse becomes rapid and feeble, its beats marking 130 or more a minute. As the disease progresses it is attended by vomiting and diarrhoea, and there is often acute pain with tenderness and swelling of the abdomen. It runs a rapid course, and too often reaches a fatal termination within a week, the advent of death being heralded by increased rapidity and feebleness of the pulse, hurried and difficult breathing, distention of the abdomen, hiccough, the breaking out of a cold clammy sweat, vomiting, and delirium. Though an exceedingly dangerous disease, and one attended by a very high rate of mortality, it is not absolutely fatal, and in its treatment remedial measures should be persisted in as long as possible, for recovery sometimes takes place after all hope has been abandoned.

From the nature of this disease it will be evident that preventive measures must include the greatest possible care on the part of the medical practitioner and nurse to avoid communicating septic matter to the patient, and in preventing the retention of anything that may cause it to originate. To this end it has been proposed that everything touching the patient, the hands, instruments, catheters, syringes, &c., should be first rinsed in an antiseptic solution of carbolic acid (1 to 20), and that all subsequent washings and syringings should be performed with a weak solution of the same kind (1 to 40). The treatment of the disease itself must vary according to the special circumstances of the patient, the type of the disease, and the various stages through which it passes. At the outset it may call for active antiphlogistic remedies, including depletion and the use of such drugs as *veratrum viride*, *aconito digitalis*, or *salicylic acid*, but when the patient has passed the acute stage the treatment must be of a different kind. The intense pain of the disease may be alleviated by the use of opium or morphia internally, or by the application of laudanum by means of poultices to the abdomen. Other measures are the external application of warm poultices or turpentine fomentations, and the use of the warm antiseptic douche internally. The most abundant supply of fresh air that can be admitted with safety to the patient should be secured, and as the disease is of a very exhausting character, nutritious food and stimulants should be administered in small quantities at short intervals.

PUER'PERAL INSANITY is the name given to a form of insanity dependent upon childbearing, and which may be developed during pregnancy, after parturition, or during nursing. Where it occurs during pregnancy it generally arises from anæmia or from a serious interference with the functions of the digestive organs. It is characterized by delusions, anxiety, melancholy, and in the severer forms with a tendency to suicide; but the prognosis is generally favourable, and recovery often ensues after the period of gestation. The more common form of the disease, however, is that which makes its appearance after parturition, and which generally occurs within a week or ten days after delivery. It is usually preceded by sleeplessness, agitation, restlessness, and more or less apprehension of coming evil. When the attack has commenced sleep is often altogether absent, the skin becomes dry and hot, the eyes are bright, the tongue dry and furred, the breath offensive, and the secretions of milk and lochia are either suppressed or diminished. The mental excitement is usually revealed by a great increase of loquacity, the existence of delusions, great suspicion of those in attendance, and very often an entire perversion of the feelings of

affection previously entertained for husband and child. Sudden impulsive acts of violence are not uncommon, and the patient in a paroxysm of excitement may seek to destroy herself, her child, a relative, or an attendant.

In the treatment of the disease the patient must be carefully watched day and night, and everything must be done to promote tranquillity. The nursing should, if possible, be intrusted entirely to strangers, as the sight of the members of the family tends to promote excitement. In some cases the administration of bromide of potassium in the earlier stages proves very useful, and cooling applications to the head are grateful to the patient, and tend to promote sleep. A plentiful supply of nourishment is always required, and when the disease assumes a chronic form tonic medicines, such as quinine and iron, are often of great value. The hospital statistics show that about 70 per cent. of the patients admitted with this disease are discharged cured, and if it were possible to obtain particulars of cases privately treated it would be seen that the ordinary estimate would be still more favourable. The great proportion of recoveries takes place within the first six months, after which period the proportion becomes smaller. When the disease lasts over twelve months the prospect of recovery is very doubtful. The appearance of a mental condition in which the patient becomes aware of her condition and appears like a person awakening out of a dream, the restoration of the menstrual discharge, and an increase in weight, are signs which generally precede restoration.

The disease is invariably one of exhaustion, debility, and depression, conditions which may be induced by a variety of causes, such as want, a too rapid succession of pregnancies and nursings, hæmorrhage during parturition, and any inordinate mental excitement or depression during gestation or after confinement. There is often also a hereditary tendency to this disease, and where this is the case it is readily induced by anything that causes constitutional irritation.

PUERTO BELLO. See PORTO BELLO.

PUERTO CABELLO. See PORTO CABELLO.

PUERTO RICO. See PORTO RICO.

PUFENDORF, SAMUEL, BARON VON, was born in 1632, at the small town of Chemnitz in Saxony, in whose neighbourhood his father was settled as a Lutheran clergyman. He received the rudiments of his education at Grimma, and from thence removed to the University of Leipzig, where he studied law and theology, but about the year 1656 he repaired to the University of Jena, and devoted himself to the study of mathematics.

His first work appeared at the Hague in 1660, under the title of "Elementa Jurisprudentiæ Universalis." The work was dedicated to the elector palatine, who, having founded at Heidelberg a professorship of the law of nature and nations, gave the chair to Pufendorf, and also intrusted him with the education of his own son (1661). During his residence at Heidelberg Pufendorf wrote a work on the constitution of the Germanic empire, entitled "De Statu Imperii Germanici," in which he pointed out the incongruities and defects of this political system, and suggested remedies for abuses. The work was printed at Geneva under a fictitious name, and attracted great attention. But as it was soon known to be Pufendorf's, and excited hostility against him on the part of some of the German civilians and the more powerful members of the Germanic body, he gladly accepted, in 1670, an invitation from Charles XI. of Sweden, who gave him the chair of the law of nations in the newly-established University of Lund. At Lund he published the work on which his reputation is founded, "De Jure Naturæ et Gentium." It is a work of merit, and a valuable contribution to the principles of jurisprudence. In 1688 the Elector of Brandenburg, Frederick William, invited him to

Berlin, with the consent of the King of Sweden, for the purpose of writing the history of his life and reign. He died at Berlin in October, 1694.

PUFF-ADDER (*Clotho arietans*) is a poisonous snake belonging to the same family (Viperidae) as the English ADDER. It is a native of South Africa, and is one of the most dreaded of the venomous snakes found in Cape Colony. It attains a length of between 3 and 4 feet, and has a very broad, flattened, heart-shaped head, and a short thick tail. The eyes are small, and the nostrils are placed near the end of the muzzle. It is of a yellowish-brown colour, marked with darker bands and spots, and harmonizes well in hue with its surroundings, being found generally on sandy ground. The name is derived from its habit of inflating the upper part of its body when provoked and about to spring. When about to attack it is said to throw its head backwards, so that it cannot injure a person standing in front of it. An allied species, *Clotho cornuta* (the horned viper or hornman of the Cape colonists), is equally venomous. It is so called from the scales over the eyes being prolonged into a clump of lengthened spines, forming a short horn. It is from 14 to 18 inches in length.

PUFF-BALL is the name given to many species of fungi belonging to the order GASTEROMYCETES and family Trichogasteres. The puff-balls are so called from their habit of emitting when ripe a cloud of powdery dust, consisting of spores. In shape they are more or less globular, with the hymenium or spore-bearing surface inclosed in an external membrane, the peridium, which is either single or double. The interior is at first white and fleshy, but at length breaks up into a dry, brownish, powdery mass of spores and threads. The Giant Puff-ball (*Lycoperdon giganteum*) is the largest of British species, measuring several feet in circumference. When young it is good for food, cut into slices and fried. The dry mass of spores and threads is useful for applying to wounds, and the fumes arising from them when burnt are employed as an anæsthetic. The puff-balls of the genus *Bovista* are distinguished by their peridium being single and the spores always stalked. They are common in pastures and exposed situations, and are smaller and smoother than the lycoperdons. *Bovista plumbea* is a common British species. The Earth-stars (GASTER), another genus of puff-balls, are distinguished by the outer peridium splitting into several lobes so as to present the appearance of a star. The earth stars are local in their distribution, and commoner in the south of England than the other parts of Great Britain.

PUFF-BIRD (Bucconidae) is a family of birds belonging to the order SCANSORES. They have a stout conical bill, very broad at the base, which bears several tufts of strong bristles. The gape is very wide. The wings are moderate and rounded. The tail is long and broad. The toes are arranged in two pairs, the two outer being the longest. The puff-birds are all inhabitants of tropical America. The name is derived from their habit of puffing out the plumage of the head. They are solitary birds, leading a somewhat sedentary life in the recesses of the forests. They live exclusively upon insects, and lay their eggs in holes in trees. They frequent open cultivated spots near habitations, always perching on the withered branches of a low tree, where they will sit nearly motionless for hours, unless, indeed, they desery some luckless insect passing near them, at which they immediately dart, returning again to the identical twig they had just left, and which they will sometimes frequent for months. The Collared Puff-bird (*Bucco collaris*) measures rather more than 7 inches in length. It is of a red colour above, with transverse black streaks, whitish beneath, with a black band across the breast, and above this a tawny one. Above a dozen species are known.

PUFFIN (*Fratercula arctica*) is a bird belonging to the AUK family (Alcidae) and order ANSERES. The puffin is remarkable for the size and character of its bill, which is short, deeper than long, and very much compressed; both mandibles are arched and transversely grooved, and notched towards the point. The contour generally is thick and rounded, and the tail is short. The wings are also short, and used as oars; while the flight is rapid, and sustained by repeated strokes of the pinions. The legs are short, and the toes are all in front and united by membranes. The puffin is about 12 inches in length; the upper part of the body, wings, tail, and a ring round the neck are black; the under surface white. This bird is a summer visitor to Britain, and on some parts of our coast breeds in immense numbers. Enormous numbers have bred since early times on Lundy Island, which derives its Scandinavian name (*Inude*, puffin, *ey*, island) from this fact. In England it arrives early in April, and departs again about the end of August, but in some parts of Scotland it is found all the year round, the place of those emigrating south in the autumn being taken by birds from more northerly regions. It makes its nest in burrows on cliffs or low islands, often taking possession of deserted rabbit-burrows or onsting the rightful owner. The burrows are excavated to a depth of about 3 or 4 feet, and in them is deposited the single large white egg. On land the puffin appears an awkward bird, walking with a waddling gait, but it flies rapidly, and swims and dives well. The puffin has a wide geographical distribution, being found on the coasts of Norway and Iceland, reaching across to the Atlantic coast of North America, and extending down to Brittany and the Mediterranean.

PUG is a small pet-dog, usually regarded as a monstrous variety of the BULL-DOG. It is usually kept as a lady's dog, for which its small size, its comparative freedom from the usual canine odour, its good temper and affectionate disposition render it very suitable. The pug has a short close coat, usually of a fawn colour, and the muzzle and the face up to the eyes should be black. The head is round, the forehead high, the ears long and drooping, and the nose very blunt. The tail is sharply curled, and carried lying on one side of the hind quarters. The height should not exceed 15 inches, nor the weight 10 pounds. The Chinese pug has longer hair, and the Japanese pug, another drawing-room pet, has long soft hair and a very bushy tail.

PUGIN, AUGUSTIN WELBY NORTHMORE, son of Augustin Pugin, an architectural draughtsman, author of "Designs for Gothic Furniture in the Style of the Fifteenth Century," was born in London, 1st March, 1812. He was early instructed by his father in the principles of architectural drawing, and first obtained distinctive employment, under the celebrated Messrs. Gieves, in theatrical scene-painting. Having joined the Roman Catholic Church, and found a kind patron in the Earl of Shrewsbury, he devoted his energies to the ecclesiastical architecture of the middle ages. His productions soon attracted public attention by the superior talents exhibited in this line of art; and he was engaged in the designing and forming of a larger number of Roman Catholic edifices than has fallen to the lot of any other Englishman. Specimens of his artistic skill may be seen in almost every county and principal town of the kingdom. He also assisted Sir Charles Barry in the construction of the new Houses of Parliament at Westminster in 1836 and 1837. But independently of his practice as an architectural draughtsman he closely devoted his attention to literary matters. In 1841 he produced a treatise on the "True Principles of Pointed or Christian Architecture;" in 1844, "A Glossary of Ecclesiastical Ornament;" in 1849, "A Treatise on Floriated Ornaments;" and in 1851, "A Treatise on Chancel Screens," &c. His mental

faculties at length gave way from excessive labour, and he expired at Ramsgate on 14th September, 1852.

PULCHERIA, one of the great women-rulers of the dark ages, was the daughter of the (Greek) Emperor Arkadios. Her father died in 414, when she was but fifteen, nevertheless she assumed the regency for Theodosios II., her brother, and ruled so wisely that he never removed the reins of government from her hands. He died in 450, and the empress then married a brave, simple, and honourable soldier, Markianos (Marcian), who had risen absolutely from the ranks to great distinction. Her choice proved very beneficial to the state, and at her death in 453 she left her husband in assumed power. Her decease was universally mourned, for her piety and benevolence were equal to her great ability.

PULCI, LUIGI, born at Florence, 3rd December, 1431, of respectable though poor parents, became early in life acquainted with the family of the Medici, through whom he seems to have obtained an inferior office under the Florentine republic. Few particulars of his life are known. He was a welcome guest at the table of the great Lorenzo, who relished his wit and his extempore poetical effusions. Lucrezia Tornabuoni, Lorenzo's mother, urged him to write an epic poem. He undertook the task, and chose for his subject the treachery of Gano of Maganza, one of Charlemagne's vassals, who is reported in the old legends to have brought about the defeat of the French at Roncevaux in the Pyrenees. His poem is not, as has been supposed by many, a burlesque, but a combination of the serious with the facetious; it is a romance accompanied by its own parody, and it is generally regarded as the prototype of Ariosto's "Orlando Furioso." The title of "Morgante Maggiore" is a capricious one; for the giant whom he introduces, by the name of Morgante is only a subordinate character, and acts as squire to Orlando. The reason of the adjunct "Maggiore" is not perceived, unless it was given to him on account of his great strength.

The first edition of the poem of Pulci, with all its freedom of thought and expression, came out in 1481, from the press of the convent of Ripoli, at Florence, in which some of the nuns acted as compositors. The edition of the "Morgante," Naples, 1782, contains a good biography of the author. The poem has been translated into English by W. Stewart Rose. The best idea of it is, however, gained by Byron's brilliant version of a part of it (Canto I.) in the original metre; and the reader who turns to it in the works of Byron will at once perceive that first in "Beppo," and finally in "Don Juan," he used both style and metre almost without changing, from his model. Perhaps this fact says more for Pulci's genius than anything else to anyone who cannot read him in the original.

Pulci wrote also a number of satirical and some licentious sonnets, and other light poetry, including his "Confession," the copies of which are rather scarce. Pulci died at Florence in 1487.

PULICARIA is a genus of plants belonging to the order COMPOSITÆ, distinguished by its yellow rayed flower-heads, the florets of the disc having a hairy pappus surrounded by a cup-like membrane. *Pulicaria vulgaris* (the common fleabane) is found on moist sandy heaths in Great Britain. The name refers to the practice once in vogue among country people of burning the plant as a remedy against fleas, its smoke being thought to be peculiarly obnoxious to these troublesome insects. *Pulicaria dysenterica*, a larger and more common species in Britain, is found in marshes and by the sides of rivers. It has large, bright yellow flower-heads with conspicuous rays. The specific name was given under the idea that it was a remedy against dysentery.

PULLEY. The pulley is one of the simple machines or mechanical powers employed in the construction of machinery and in the transmission or modification of

force. The kinds of pulleys in use are very numerous; but they all consist of combinations of a grooved wheel, movable on an axis, and a rope lying in the groove; and the manner in which this rope passes over and under a system of these wheels, so as to connect the force with the resistance, or the power with the weight, determines the species or kind of pulley. The following are the combinations by which the principle of pulleys is put in practice:—

The *single fixed pulley* possesses no mechanical advantage, the power and the weight being equal to each other. This may be, in fact, regarded as a lever with equal arms. For, referring to the Plate (fig. 1, *a*), we see that the pulley, suspended by its hook, *G*, but free to rotate round the centre, *F*, yields equal arms, *BF*, *AF*, and the strain of *r* (the power) on the part *n* of the rope is exactly equal to the strain of *w* (the weight) on the part *E*. If they were not equal, since the machine itself manifestly gives no advantage, either *w* would pull up *r*, or *r*, *w*—whichever were the stronger.

The *single movable pulley* consists of one wheel fixed and the other movable; the power acts at one end of the rope, and the other end is fixed to an immovable obstacle; the weight or resistance is attached to the sheave or block of the movable wheel. This is shown at fig. 1, *b*, in the Plate. Here the end of the rope, *b*, is fixed, and *w* hangs from the centre, *r*, of the pulley. It is evident that the part *r* of the rope bears one half of *w*, and the part *A* the other half. In this form, therefore, $r = \frac{1}{2} w$ when there is equilibrium, and, in other words, the pulley doubles the power applied to it. It is also evident that this kind of pulley is in reality a lever of the second kind. The most usual form of application is that shown at fig. 1, *c*, where pulley *A* is the effective pulley, and pulley *b* only serves to transfer the upward pull of fig. *b* to a downward pull, usually more convenient. The power of the pulley is (theoretically) unaltered, and *r* still equals $\frac{1}{2} w$. Yet another form is shown at fig. 1, *d*, and here, since there are two pulleys in the lower or movable block, twice the advantage is gained, four parts of the cord assist in suspending *w*, and $r = \frac{1}{4} w$. This is "Smeaton's Tack," so called after the famous engineer.

By using the arrangement shown in fig. 2, where each pulley, except the first, has a separate cord, each one except the first doubles the power; the number of cords, therefore, gives the index of the power of 2, which expresses the multiplying force of the system. Two cords give (2^2) four times the power, three cords (2^3) eight times, four cords, as in the figure (2^4), sixteen times the power, i.e., at equilibrium $r = \frac{1}{16} w$ in this example. The arrangement is extremely rare in practice, however, and when it is made use of it is generally in the form shown in fig. 4. The power may be at *r* or *r'*, as convenient. The effect is the same theoretically.

White's Pulley consists of a single wheel in each of the two blocks. The wheel has a conical form, with grooves on its convex surface; and the diameters of the grooves are in arithmetical progression, by which they revolve with velocities equal to that of the line passing over them. The advantage is that the friction is reduced to that of the pivot and the two lateral faces. White's pulley is shown at fig. 3, and there being twelve suspending parts of the cord (leaving out the part *s* as ineffective), it is manifest, then, that in the example given $r = \frac{1}{12} w$, for each of these twelve parts is assisting to suspend the weight.

PULMONARIA is a genus of plants belonging to the order *ROBAGNEÆ*. The Common Lungwort (*Pulmonaria officinalis*) is a perennial herb with a creeping root-stock, which throws up a tuft of large ovate leaves with their upper surface marked with white blotches; the stems are from 6 to 12 inches high, bearing smaller oblong sessile leaves and terminal clusters of purple flowers. It is found in woods and thickets in this country, but is rare, and has

probably been introduced from the Continent. It was formerly largely cultivated in gardens under the name "Jerusalem cowslip." The lungwort is a notable example of the mediæval doctrine of "signatures." From the speckled appearance of the leaves they were thought to be providentially marked out as the natural remedy in diseases of the lungs. In this case, however, the facts were, to some extent, correct, despite the falsity of the theory on which they were based, for the leaves possess demulcent properties, and the whole plant is mucilaginous. In the north of Europe it is eaten as a potherb, and, according to Ray, in his time it was brought to table in Scotland. *Pulmonaria lanceolata*, confined in this country to the woods of Hampshire, is distinguished by its lanceolate leaves. All the species of *Pulmonaria* are pretty plants when in blossom, and are desirable for gardens on account of their early flowering.

PULMONARY CIRCULATION, the circulation of the right side of the heart, which receives the venous blood of the entire body and pumps it onwards to the lungs, whence it returns to the left (or systemic) side of the heart, and is distributed to the body. See CIRCULATION OF THE BLOOD.

PULP is the name given in common language to such parts of plants as seem to be semitolid. This substance appears to the naked eye as a mucilaginous unorganized mass of the nature of a secretion; but it is in reality composed of very thin-sided cells which have little power of cohesion, and secrete in their interior a greater abundance of fluid than is usual. Pulp may therefore be regarded as young though perfectly formed tissue filled with the secretions peculiar to the species. It is also in some cases mixed with an abundance of very long, branching, narrow tubes (lactiferous tissue), which pass through it in all directions in the form of the most delicate ramifications. The pulp of the grape affords a good example of this. To the naked eye it appears to be nothing more than a fleshy homogeneous mass that may be compared to half-consolidated gum; but under the microscope it is found to be a congeries of oval transparent bags, turgid with fluid and very easily ruptured; treated with iodine they lose their transparency in some measure, and acquire a brown colour, when their limits become very distinct. The same re-agent stains still browner the vessels of the latex, whose course and position are thus brought clearly into view. In a few minutes, however, the colouring fades away in the latter, till they become as indistinct as they were before the iodine was applied; it is therefore necessary that the observation should be made as soon as the iodine has seized upon the latex or its tubes.

PULPIT. This term is derived from the Latin, the *pulpitum*, which signifies that part of the Roman stage (distinguished from the orchestra) on which the actors recited and performed their parts. The French *pupitre* and the English *pulpit* both come from the same source, but are dissimilar in signification, the former meaning merely a reading desk; French *chaire* (Lat. *cathedra*) being the term that corresponds with our English *pulpit*. Great cost, both of material and workmanship, was frequently bestowed on pulpits in early times; and some of them rank among the most celebrated monuments of art of their period, and for a long time pulpits appear to have been treated as an important architectural feature of the interior.

PULQUE, a vinous Mexican beverage obtained by fermenting the juice of the agave. It resembles cider, but has an odour similar to that of putrid meat. It is largely consumed in Mexico, being retailed in open sheds called *Pulquerias*, which are also used as places of resort and amusement. A spirit is also distilled from it.

PULSE is the common name for the edible seeds of leguminous plants, which yield a useful farinaceous matter, such as the pea, bean, lentil, and kidney bean.

PULSE. In the article CIRCULATION OF THE BLOOD reference is made to the phenomenon of the pulse. This is occasioned by the wave of pressure following each beat of the heart all along the arterial system, so that for each heart-beat there is at any given point a temporary expansion of the artery, succeeded by a return to the normal calibre or somewhat less. Where the artery comes near the surface, as at the wrist, the throbbing of the pulse is very plainly felt, and serves as a valuable record of the frequency and strength of the heart's action. A machine, called the sphygmograph (Gr. *sphugmos*, a throb or pulse), has been arranged to record the pulse-wave. The first instrument of the kind was invented by Ludwig in 1847; those at present in use are Marey's and Dudgeon's. All are alike in principle. There is a framework to be attached to the arm, and to carry a clockwork by means of which a strip of smoked paper is carried along at a fixed and uniform rate under the writing point of a lever. This lever is the last of a system of levers, beginning with a delicate steel spring which rests upon the artery and receives its throbbing motion as the pulse-wave passes the point. Thus the movements of the pulse are recorded as a continuous wave line upon the smoked paper in a magnified form. An ecentric gives the power to modify the pressure on the pulse. Annexed are some pulse tracings of the sphygmograph.

The pulse-wave is quite a distinct thing from the forward motion of the blood, just as waves on the

Fig. 1.



Fig. 2.



Fig. 3.



Pulse-waves, traced by the Sphygmograph.

surface of a river (due to wind, &c.) are distinct from the flow of the current. The pulse-wave travels about 30 feet a second, while the blood does not travel nearly 2 feet a second even in the larger arteries, and much slower than that in the smaller ones. The result of this rapidity is, that the pulse-wave is already beginning to lose itself in the capillaries by the time the contraction of the heart, which started it, is ceasing. It is, therefore, manifest, as indeed the sphygmograph tracings record, that the throb of the pulse is very sudden, and the return of the artery to its normal size very gradual in comparison with it. These curves are observed to show secondary curves upon them; and as these secondary curves vary considerably, according to the variations in tone of the blood system, they are of the greatest value to the physician in his diagnosis. They are due partly to the inertia of the elastic walls, partly to a rebound from any curve or other obstacle to the onward progression of the wave, which is thus partly reflected. In every pulse there is one such secondary curve, usually termed the dirotic curve, and in a state of low tone this diroticism of the pulse is so great (as in fig. 2) as to cause a double pulse, clearly felt under

the finger, as shown by the sphygmograph. The pulse of fig. 1 shows a much more healthy tone, with a small dirotic rise. Fig. 3 is taken at an artery distant from the heart, and the effect of this is to throw the dirotic curve a long way off the initial rise; here it quite forms part of the succeeding pulse-wave. On the other hand, a pulse showing no diroticism, probably indicates an artery rigid from disease.

The frequency of the pulse varies greatly with age, the pulse of a healthy adult man being from 70 to 75 a minute. But beyond this great factor, temperament, sex, food and drink, exercise, time of day, posture, atmospheric pressure, and temperature all affect the pulse. The average rates at various ages have been ascertained to be as follows:—

	Pulses per minute.
Before birth,	150
Immediately after,	140 to 130
First year,	130 to 115
Second year,	115 to 100
Third year, &c.,	100 to 90
Seventh year, &c.,	90 to 85
Fourteenth year, &c.,	85 to 80
Twenty-first year, &c.,	80 to 75
Thirtieth year,	75 to 70
Sixtieth year,	70 to 60
Ninetieth year,	75 to 65

The rise in extreme age is very curious, and has not yet been accounted for. With regard to the other circumstances, sanguine and excitable people have a quicker pulse than phlegmatic, and (as might be imagined from this) women have a quicker pulse than men. Food accelerates the pulse. Excitation or excitement also accelerates it. Sleep retards it, but waking greatly accelerates it; the pulse is quickest in the morning, all things else being the same, and slows during the day, the variations being greater as the day advances, so that it falls rapidly at night. Standing quickens the pulse, sitting retards it, lying down retards it still more; but it has been shown that these posture-effects depend largely on muscular action, so that standing while supported, or maintaining a recumbent posture by force against a pressure inclined to push one upright, do not produce the calculated effects of standing or lying down. The rarer the atmosphere the quicker the pulse, an effect often very painful to sensitive persons who ascend mountains. Scientific observers have found their pulse beating actually at double rates on the summit of Mont Blanc. Heat accelerates the pulse up to a certain temperature, after which, in extreme heat, the pulse becomes irregular and feeble. Thus in a series of experiments on the pulse of rabbits, it was found that the rate of the pulse at 105° Fahr. was more than double of that at 60° Fahr., but on raising the temperature to 113° the heart altogether ceased to beat.

The proportion of pulse-beats to respiratory efforts is very regularly maintained in health at three or four pulse beats to each inspiration. It is a grave sign of disease when the two cease to have this relation.

PULTAVA. See **POLTANA**.

PULTENEY, WILLIAM, Earl of Bute, was born in 1684, and was sent first to Westminster School, and then to Christ Church, Oxford. He afterwards travelled on the Continent, and on his return home, about 1705, was brought into Parliament for the borough of Hedon, in Yorkshire. He attached himself to the Whig party, and on the accession of George I. was appointed secretary-at-war, but when Walpole resigned in 1717 Pulteney also gave up his office. Soon after this, however, a coolness took place between the two; but it was not till 1725 that Pulteney openly threw himself into the ranks of opposition, and began that course of bitter and incessant attack upon the minister which did not cease till he had driven him from

power in 1742. But the composition of the new cabinet disappointed the expectations both of partisans and of the public; and a universal storm of indignation was raised, when, after the lapse of a few months, Pulteney was raised to the House of Lords as Earl of Bath. From this moment the late popular idol became quite insignificant. He died 7th July, 1764.

PUMA (*Felis concolor*) is one of the larger members of the family FELIDÆ. It is a native of America, where it is generally called a lion, just as the jaguar of the same regions is called the tiger. In appearance it is not unlike a small lioness, its hair being of a nearly uniform fawn colour; but the inner sides of the legs, as well as the under parts of the throat and belly, are lighter, inclining to white; there is no mane in the male. The body is about 40 inches in length from the snout to the root of the tail, which is thick with a tuft of black hairs at the tip, and measures some 26 inches in length. The puma is abundant in South America, extending as far south as Tierra del Fuego, and being found at high elevations on the Andes. In North America its range has of recent years become very restricted. It is a good climber, and can also swim well, though it appears to avoid taking to the water when possible. It is a cowardly animal, and very rarely attacks man. It preys on deer, ostriches, llamas, and monkeys, and often devastates herds of cattle and sheep, more rarely attacking horses. After eating its fill it is said to cover up the remainder of its prey with leaves, &c., and, according to Darwin ("Voyage in the *Beagle*"), this habit often leads to its destruction, for the condors descend to partake of the feast, and, being driven away by the rightful owner, rise into the air in a body, and so discover to the native huntsman the proximity of the puma. In the Pampas the puma is taken with the lasso, and in Chili it is hunted by a peculiar breed of dogs. Its flesh is eaten, and is said by Darwin to resemble veal in flavour. Unlike its namesake of the Old World the puma is said never to utter a cry except in the breeding-season, and then only rarely. When taken young it is easily tamed, and in the domesticated state exhibits all the playfulness of a kitten.

PUMICE is the froth produced upon the surface of glassy lavas. As the molten mass undergoes consolidation the imprisoned steam and other gases escape with considerable violence, sometimes blowing out the surface into filamentous threads [see *PELE'S HAIR*], and always rendering the upper layer a mass of bubbles. When the material is thoroughly molten the best quality of pumice is formed; when it is viscid, or charged with undissolved crystals, the surface assumes a cindery aspect, and the jagged fragments are termed "scoriæ." Pumice is readily seen to be composed of a mass of thin, elongated, glass-bubbles, and its white appearance is due to the repeated reflection of light from the innumerable minute surfaces.

PUMP is the general name given to any hydraulic machine for raising water with the aid of the pressure of the atmosphere. All pumps can be ranged in three divisions—the sucking pump (common pump), the lifting pump, and the force pump.

Common Pump.—A diagram is given in the Plate illustrating this article. The machine consists of two parts—the suction tube AM , and the body of the pump AB . The diaphragm AC separates the two, and is closed by a valve E , opening upwards. The piston K contains a valve F , also opening upwards. When the handle is raised the piston is thrust down to the position G , the valve F being opened by the pressure beneath it. On pressing down the pump handle the piston is drawn up to the position K , and the space in the body of the pump between G and K is deprived of its air, which the piston pushes before it. The air in the suction tube AM is therefore at greater density than that in the space AK of the body, and therefore pushes open the valve E , rushing

into the comparative vacuum above to fill it; but since the whole space from M to K is now filled by air which previously only filled AM , it is manifest that the air within the pump has become less dense than a corresponding amount of atmospheric air, which it exactly equalled at the beginning of the experiment. Consequently the pressure of the atmosphere upon the surface of the water at M is greater than the pressure of the air within the suction tube, and the outer air drives water into the tube through the perforations at its base, until the inner air is compressed to the ordinary atmospheric elasticity. Suppose the water rises to x by reason of this. At the next stroke of the pump-handle similar results will ensue, and the water will rise to y , a third stroke will bring it to z , and a fourth stroke will fill the suction tube. Further strokes will fill the body of the pump, and at each rise of the piston a body of water, equal to the space from K to G , is lifted by the piston and runs through the spout, while each descent of the piston allows a like body of water to pass through the piston valve F , ready for the next discharge. The discharge of water is therefore discontinuous; but the addition of a cistern opposite the spout so arranged as to receive more water at each stroke than can run away through the spout will convert this into a regular incessant flow. The limit to the action of the pump, supposing the parts all to fit perfectly, is, that the distance AM shall be under 34 feet (equal to 30 inches of mercury), because 34 feet of water, or thereabouts, balances a column of atmosphere of the same diameter. If AM were over 34 feet high the water would rise to 34 feet and remain there, because the inner and outer pressures would be exactly equal, the column of water within the suction-tube balancing the atmosphere without. As to the force required to work the pump, a little consideration will show that the piston throughout its whole ascent is opposed by an effort equal to the weight of a column of water having the same base as the piston, and a height equal to that of the surface of the water in the body of the pump above that of the water in the well or reservoir, to which must be added the weight of the piston and rod and their resistance by friction. The descent of the piston is aided by gravity, and only encounters a slight frictional resistance in addition to the weight of the handle.

Lifting Pump.—Here the action is reversed as compared with the common pump. The piston valve F , and the stationary valve E , both open upwards as before, but the piston is below the stationary valve. The piston-rod z is fixed by the joint r to a frame txy , and on the lower rod of this frame, xr , the piston is fixed by the stem, rz . The whole body of the pump, $ABDC$, is under water. As z is drawn up and down by the pump handle, so the piston F moves up and down in the pump, and at each upward stroke it raises, pushing before it, the quantity of water contained in the section AK of the tube passed over by the stroke. When the piston descends to IK the water below, continually under the pressure of the atmosphere, passes through the valve E , and is ready to be lifted. Here also the flow is intermittent, unless aided by a cistern, as above-named. The pressure on the piston is the weight of the column of water having the base of the piston, of the height of the orifice or spout above the level CA of the water in the well or reservoir; to which must be added the weight of the piston-rod and frame and their frictional resistance. As before, the descent of the piston will be comparatively unimpeded.

Force Pump.—Here the piston has no valve, but the valve F is placed at the entrance into the body of the pump of the tube of ascension FV . The water is raised above r as before; but when in the body of the pump, filling it up to K , the highest range of the piston, it is forced down by the descent of the latter towards G , its lowest point; and, since E is closed by the pressure, it

escapes through *r*. At each upward stroke the body of water contained by the pump between *κ* and *α* is raised; at each downward stroke this same body of water is driven through the valve *r* into the tube of ascension. As before, the distance *α* *κ* must not exceed 34 feet, but the distance *r* *v* may be any height desired. The more distant the orifice *v*, and therefore the greater the weight of water in the tube of ascension *r* *v*, the harder is the work of the pump, for at every descent of the piston the whole of the water in *r* *v* has to be lifted by the freshly entering body of water *κ* *α*, itself driven onwards by the piston. The total resistance to the piston in this case also is, therefore, that of a column of water whose base is the piston, and whose height that of the orifice of delivery above *κ*, the level of the water in the well or reservoir; but this resistance is in two portions, one active against the ascent, and the other against the descent of the piston—not as in the other pumps, where all the resistance is against the ascent.

PUMPERNICKEL, a species of rye bread eaten by the inhabitants of Westphalia. The loaves sometimes weigh 60 lbs. The term is said to have originated in the expression of a French soldier, who, contemptuously rejecting the coarse fare, exclaimed, *C'est bon pour Nicolas* ("This is fit for Nicolas," his horse).

PUMPKIN. See GOURN.

PUN (variously derived from the Old English *punian*, to bruise, and the French *pointe*, a point or witticism) has been defined by Addison (*Spectator*, No. 61) to be a conceit arising from the use of two words that agree in the sound, but differ in the sense. Sometimes, however, the pun is effected by the employment of only one word, which is susceptible of a double application, as when one who had undertaken to pun upon any subject that should be given him, on being desired to make a pun on the king, answered that "the king was no subject."

The practice of punning has been indulged in at all times and by all manner of men, and Addison, in the paper above referred to, traces the existence of the practice from the time of Aristotle downwards. In the majority of cases the spirit of humour has been predominant in the fabrication of puns, but some of the prophets of the Old Testament use the play upon words as a means of giving emphasis to their oracles. Dr. Samuel Johnson is reported to have said that "the man who would make a pun would pick a pocket," and to have expressed a similar sentiment in true Johnsonese, by asserting that "he who would violate the sanctities of his mother tongue would invade the paternal till without remorse;" but the great doctor himself fell into the sin he denounced on more than one occasion. Dr. Oliver Wendell Holmes solemnly lays down the law upon the subject, by asserting that "Life and language are alike sacred. Homicide and *vericide*—that is, violent treatment of a word, with fatal results to its legitimate meaning, which is its life—are alike forbidden." When, however, we find that in the next sentence he goes on to remark that "Manslaughter, which is the meaning of the one, is the same as man's laughter, which is the end of the other," we perceive that the genial essayist is only in fun, and that he has as keen a relish as the rest for this form of wit.

Those who have a taste for skilful punning will find ample material in the writings of Hood, Hook, and Sydney Smith, and there is also a very clever paper in the *Guardian* (No. 36), attributed to a writer of the name of Birch, which contains what is called "A Modest Apology for Punning." See also Rowley's "Puniana" (two vols., London, 1874).

PUNCH, the name of the principal character in a well-known puppet show which is exhibited about the streets, and which appears to have originated in Italy. The word is a corruption of the name of Policinella, the Neapolitan clown. But the show itself, or rather the puppets, are

styled by the Italians "Fantoccini." Galiani, in his "Vocabolario del Dialetto Napoletano," gives the following account of the origin of Policinella, or rather Poleccinella, as it is pronounced by the Neapolitans:—A company of strolling comedians once arrived at the town of Acerra, near Naples, in the season of the vintage, and were so amused at the buffooneries of one of the peasants, named Puccio d'Aniello, that they engaged him as one of their company. The engagement proved profitable to both parties, and the comedians had crowded houses wherever they went. After Puccio's death his place was filled by a well-taught adept in his art, who assumed his name, softened into Poleccinella, and also his manner and costume, with a mask which perpetuated the grotesque features of the facetious vintager. By degrees personifications of the original Poleccinella were multiplied all over the country, and the name and character have thus become immortal. The performances of Punch have been very popular in England ever since the commencement of the seventeenth century. The *Spectator* contained a criticism of one of the performances, written by Addison. The show requires the assistance of only two persons, one to carry the theatre and work the puppets, the other to play a mouth-organ and drum, and occasionally hold a dialogue with the characters represented.

The comic periodical called *Punch* was established in 1840, and owing to the excellence of its illustrations and humour of its letterpress, has maintained quite a national popularity ever since. Among its contributors have been Thomas Hood, Gilbert & Becket, Thackeray, and Douglas Jerrold; and in its pages John Leech first displayed his marvellous fertility and robust humour. It has long been the habit of the contributors to dine together every Wednesday, and it is said that the weekly dinner has been one of the chief things which contributed to *Punch's* success, as the contents of the forthcoming number are then discussed. When the cloth is removed and the dessert laid on the table, the first question put by the editor is, "What shall the cartoon be?" At these dinners none but the staff proper are permitted to attend. As an illustration of the benefit arising from these meetings, we may mention that Jerrold always used to say, "It is no use any of us quarrelling, because next Wednesday must come round with its dinner, when we will all have to shake hands again."

PUNCTUATION is the art of dividing written composition into sentences, and the subdivision of these into clauses by means of stops or points, so as to indicate the meaning and assist the reader to a proper enunciation. Most ancient languages were written without points, and without any divisions between the words, and in most of the earlier inscriptions and manuscripts we find the letters placed at equal distances throughout, and destitute of any mark of division whatever. The earliest use of punctuation is ascribed to the Alexandrian grammarian Aristophanes, who lived in the third century B.C., but whatever his system may have been, it afterwards became neglected and forgotten. Among the reforms effected by Charlemagne was the reintroduction of punctuation, the signs used being designed by Warnefried and Alcuin. The system at present in use in Europe was introduced in the latter part of the fifteenth century by the Venetian printer Aldus Manutius, to whom we owe the period, colon, semicolon, and comma, the marks of interrogation and exclamation, the parenthesis and dash, as well as the hyphen, apostrophe, and quotation marks, and as these were adopted by subsequent printers their use soon became universal. With few and unimportant exceptions all European nations use these signs and attach to them the same value.

PUNCTUM CÆCUM, or the "blind spot" in the eye, is the part of the surface of the retina at which the optic nerve enters the eye. At this spot the retina has not sufficient delicacy of fibre to receive impressions from the

rays of light which, coming from external objects and converging there, should form images of those objects: consequently the part contributes nothing to the perception of vision. From experiment it is found that the part of the retina on which the rays of light produce no impression, is a circular spot whose diameter is one-seventh of the diameter of the eye, and having its centre a little way distant from the axis or point directly opposite the centre of the pupils. See BLIND SPOT.

PUNDIT is the title bestowed in India upon those members of the Brahman caste who study and teach the various branches of Sanskrit learning. This work is believed to be of a highly religious nature, and its professors, though they demand no fees for imparting instruction, are yet well supported by the gifts of the devout or out of endowments which pious persons have set apart for this purpose. Unlike European teachers, the pundits rely upon memory rather than upon written works for many branches of study, and beginning early in life and devoting themselves wholly to the work, they become able in time to repeat long and elaborate books from beginning to end without hesitation or mistake.

PUNFIELD BEDS, in geology, a thin series of layers occurring in the WEALDEN formation at Punfield, in Dorsetshire, noteworthy on account of their yielding marine and brackish-water fossils. Species of *Ostræa*, *Mytilus*, and *Ammonites* are found in this zone, whereas almost all the other Wealden strata are destitute of any but truly fresh-water and terrestrial forms.

PUNIC WARS, the three great wars between the Carthaginians (*Pœni*) and the Romans.

(1) The *First Punic War*, which lasted nearly twenty-three years (B.C. 264-41), arose out of the application of the Mamertines of Messina to Rome (B.C. 264) for aid against the Carthaginians and against Hiero, king of Syracuse. At the beginning of the war the Carthaginians were masters of the sea, and possessed a well-furnished treasury, which enabled them to enlist a large number of mercenaries. These hired forces, however, were no match for the citizen soldiers of Rome, whose native vigour more than compensated for her limited resources. In B.C. 263 Hiero was compelled to yield to the Romans, and from that time he became their faithful ally. During this war (B.C. 261) the Romans first built large ships of war. In B.C. 242 the Romans, under the Consul C. Lutatius Catulus, completely defeated the Carthaginians in a sea fight near the Ægates, a group of islands off the western point of Sicily. This battle put an end to the war. A peace was thereupon concluded on the following terms:—That the Carthaginians should evacuate Sicily and the adjacent small islands; that they should pay \$200 talents to Rome within ten years; that they should release all Roman prisoners without ransom; and that they should not make war on Hiero or his allies.

(2) The causes of the *Second Punic War* are to be found in the position in which the two parties were left by the first—the Romans still dreading the power of Carthage, and the Carthaginians burning to avenge their losses. In the meantime Rome committed an act of aggression by seizing upon the Island of Sardinia (B.C. 237). At length, in the year 218 B.C., Hannibal commenced hostilities by taking Saguntum, a town on the eastern coast of Spain, some distance south of the Ebro, which was under Roman protection, and by crossing the Ebro, which had been fixed by a treaty (B.C. 226) as the boundary between the Roman and the Carthaginian possessions. Hannibal crossed the Pyrenees into Gaul, and thence made his passage over the Alps into Italy. The details of his march into Italy, his victories at the Ticinus, the Trebia, and the Trasimene Lake, his complete overthrow of the Romans at Cannæ, the indecisive progress of the war in the following years, during which Fabius Maximus and Marcellus kept Hannibal

in check, and the complete turn of the scale in favour of the Romans by the destruction of Hasdrubal's army (B.C. 207), are recounted under HANNIBAL. The exploits of Scipio Africanus in Spain, his invasion of Africa, and his defeat of Hannibal at Zama (B.C. 202), are related in the article SCIPIO. The battle of Zama concluded the war. Peace was granted to the Carthaginians on the following terms:—They were to retain only their territory in Africa; they were to give up all their ships except ten triremes, and all their elephants; they were to pay the Romans 10,000 talents, at the rate of 200 a year; and they were to commence no war without the consent of Rome. Thus Carthage became little more than a vassal of Rome.

(3) The *Third Punic War* began in the year 149 B.C., and lasted only three years. When the Carthaginians found that the Romans were resolved on their utter destruction, they made the most vigorous preparations for a resolute defence. The consuls Censorinus and Manilius attacked the city on opposite sides, but were repulsed. Other reverses followed. The consuls of the following year (148 B.C.) were equally unsuccessful. But in the next year (147 B.C.) Scipio Æmilianus finished the war by the capture of Carthage. [See SCIPIO.] By a decree of the senate the city was razed to the ground, and "Africa" was made a Roman province.

PUNICA. See POMEGRANATE.

PUNISHMENT. The verb to *punish* (whence the noun-substantive *punishment*) is from the French *punir*, and the French *punir* is derived from the Latin *punire*, anciently *penire*, which is connected with *pena* and the Greek *poînê*. *Poînê* signified a pecuniary satisfaction for an offence, similar to the *vergeld* of the German codes.

The original idea of punishment was pain inflicted on or endured by a person as a satisfaction or atonement by him for some offence which he had committed. According to this conception of punishment, it appeared to be just that a person should suffer the same amount of pain which he had inflicted on others by his offence; and hence the origin of the retaliatory principle of punishment, or the *Lex Talionis*.

The infliction of pain for the purpose of exacting a satisfaction for an offence committed is *vengeance*, and punishment inflicted for this purpose is *vindictive*. But inasmuch as the proper end of punishment is to deter from the commission of offences, punishment inflicted on the vindictive principle often fails to produce the desired purpose, and moreover involves the infliction of an unnecessary amount of pain. All punishment is an evil, though a necessary one. The pain produced by the offence is one evil; the pain produced by the punishment is an additional evil, though the latter is necessary in order to prevent the recurrence of the offence. Consequently a penal system ought to aim at economizing pain, by diffusing the largest amount of salutary terror, and thereby deterring as much as possible from crimes, at the smallest expense of punishments actually inflicted.

It follows from what has been said that it is essential to a punishment to be *painful*. Accordingly, all the known punishments have involved the infliction of pain by different means, as death, mutilation of the body, flogging or beating, privation of bodily liberty by confinement of various sorts, banishment, forced labour, privation of civil rights, pecuniary fine. The punishment of death is called *capital* punishment; other punishments are sometimes known by the name of *secondary* punishments. Moreover, the pain ought to be sufficiently great to deter persons from committing the offence, and not greater than is necessary for this purpose.

A punishment ought further to be, as far as the necessary defects of police and judicial procedure will permit, *certain*; and also, as far as the differences of human nature and circumstances will permit, *equal*. If a punishment be pain-

ful, and the pain be of the proper amount, and if it be likewise tolerably equal and certain, it will be good, as a punishment.

The reformation of convicts who are suffering their punishment is an object which ought to enter into a good penal system; but it is quite a distinct thing from the punishment itself, the object of which is to prevent all persons from committing crime.

A question is sometimes raised as to the right of a government to inflict death as a punishment for crimes, or, as it is also stated, as to the lawfulness of capital punishment. That a government has the power of inflicting capital punishment cannot be doubted; and in order to determine whether that power is rightfully exercised, it is necessary to consider whether its infliction is, on the whole, beneficial to the community. The following considerations may serve to determine this question respecting any given class of crimes. Death is unquestionably the most formidable of all punishments: the common sense of mankind and the experience of all ages and countries bear evidence to this remark. Moreover, capital punishment effectually gets rid of the convict. It may be added, as subordinate considerations, that death is the cheapest of all punishments, and that it effectually solves all the difficult practical questions which arise as to the disposal and treatment of convicted criminals. On the other hand, capital punishment is likely to become unpopular; and hence, from the unwillingness of judges and juries to convict for capital offences, and of government to carry capital punishments into effect, it is uncertain. Whenever the infliction of capital punishments becomes uncertain, their efficacy ceases, and they ought to be mitigated. An uncertain punishment is not much feared. Capital punishments ought therefore to be pronounced only for crimes which would not be effectually prevented by a secondary punishment, and for which they are actually inflicted with as much constancy as the necessary defects of a judicial procedure will allow.

A royal commission, appointed by the queen in 1865 to inquire into the laws relating to capital punishment, unanimously recommended—(1) That the punishment of death be retained for all murders deliberately committed with express malice aforethought, such malice to be found as a fact by the jury; (2) that the punishment of death be also retained for all murders committed in, or with the view to, the perpetration, or escape after the perpetration, or attempt at perpetration, of any of the following felonies:—Murder, arson, rape, burglary, robbery, or piracy; (3) that in all other cases of murder the punishments be penal servitude for life, or for any period not less than seven years, at the discretion of the court.

The commissioners further observed "that upon another important point there is a great preponderance of opinion against the present state of the law. The witnesses whom we have examined are, with very few exceptions, in favour of the abolition of the present system of public executions, and it seems impossible to resist such a weight of authority. We therefore recommend that an Act be passed putting an end to public executions, and directing that sentence of death shall be carried out within the precincts of the prison, under such regulations as may be considered necessary." The three first recommendations are now generally acted on, and since 1868 all executions have been conducted within prisons under the provisions of the 31 Vict. cap. 24.

PUNJAB (*Panj-ab*, the Five Rivers), a province of British India, under the administration of a lieutenant-governor, lying between 27° 39' and 35° 2' N. lat., and between 69° 35' and 78° 35' E. lon. The area under direct British administration is 106,632 square miles; the population, according to the census of 1881, was 18,850,437. The native states in dependence upon the lieutenant-governor of the Punjab have an estimated area

of 35,817 square miles, and a population of 3,861,688 persons. The Punjab is bounded on the N. by Kashmir (Cashmere) and the Hill States of Swat and Boner; on the E. by the River Jumna (Jamuna), the North-western Provinces, and the Chinese Empire; on the S. by Sind, the river Sutlej (Satlaj), and Rajputana; and on the W. by Afghanistan and Khelat. The capital is Lahore, situated about the centre of the province, but the principal city in population and importance is Delhi, the ancient metropolis of the Mogul dynasty.

Physical Aspects.—In its strict etymological sense the Punjab, or region of the Five Rivers, comprises only the tract of country inclosed and watered by the confluent streams of the Sutlej (Satlaj), the Beas (Bias), the Ravi, the Chenab (Chinab), and the Jhelum (Jhilan). But modern territorial arrangements have included under the same designation three other well-demarcated tracts, namely—the Sind Sagar Doab, or wedge of land between the Punjab proper and the Indus; the Derajat, or narrow strip of country west of the Indus, and stretching up to the Sulaiman Mountains; and the Cis-Sutlej districts, or table-land of Sirhind, between the Punjab proper and the Jumna (Jamuna), the greater part of which belongs historically and physically to the North-western Provinces, though now transferred for administrative purposes to the lieutenant-governor at Lahore.

The Punjab plain belongs naturally to the same wide and level table-land as the desert of Rajputana and the thirsty province of Sind. Suffering like the rest of Northern India from a scanty and precarious rainfall, it would present a similar expanse of barren sand to that which stretches along its southern border were it not for the fertilizing influence of the great rivers, which take their rise among the snow-clad peaks of the Himalayas, and bring down a perennial supply of water during the driest seasons to the burnt and almost rainless country on either side.

Throughout the Punjab, except upon the hills, wood is scarce. The uplands are generally covered only with grass, shrubs, or low jungle of mimosa. Clumps of trees, however, especially palms, *pipals*, and banyans cluster around the village sites; the mango grows in the south-east Punjab; and in the Derajat large areas are covered with date trees. Government has done much to encourage arboriculture, both by forest conservation and by planting groves round cantonments and public buildings, or along roads and canals. The fauna of the province includes tigers, lions, leopards, hyenas, lynxes, wolves, bears, jackals, foxes, and other carnivores; *nilguis*, antelopes, deer, and other ruminants; wild boar, porcupines, monkeys, and bats; parrots, jungle-fowl, pheasants, partridges, quail, pelicans, eagles, vultures, and many other birds; crocodiles, cobras, and many poisonous snakes. Camels thrive on the hot southern plains; herds of buffaloes revel in the water-side meadows, and excellent horses are bred in the north-eastern pasture lands, for the use of the chiefs and gentlemen, who pride themselves upon their equestrian habits.

Agriculture.—The tillage of the Punjab extends mainly along the foot of the boundary mountains, and stretches in long strips by the side of the great arterial rivers. Out of a total area of about 65,000,000 acres, 28,500,000 are returned as under cultivation, while 13,000,000 are cultivable but still untilled, and 30,000,000 are absolutely barren. The agricultural year is divisible into the *rabi* or spring harvest, and the *kharif* or autumn harvest. For the former the principal crop is wheat. Next come barley and gram, 1,604,132 acres. Pease and other pulses cover a small area, and tobacco and vegetables are grown on garden plots. Tea cultivation is followed with success. Cotton is grown upon 650,000 acres, and sugar-cane upon 350,000. The methods of agriculture still retain their

primitive simplicity, scarcely differing from those in use during the Vedic period. Artificial irrigation is almost universal, except in the country immediately below the hills, and in the inundated tracts beside the great rivers. Manure is applied only in the vicinity of villages, and to the best crops, such as sugar-cane, cotton, and rice, which grown near wells. Rotation of crops is confined chiefly to manured soils, where, after a rich crop, poorer and poorer staples are sown successively until the manure is exhausted; when another dressing becomes necessary, followed by a similar cycle of crops. Cultivation is quickly but steadily advancing in the Punjab. The great mass of the landed property in the Punjab is held by small proprietors, who cultivate their own land in whole or in part. The chief characteristic of the tenure generally is that these proprietors are associated together in village communities, having to a greater or less extent joint interests, and under our system of cash payments, limited so as to secure a certain profit to the proprietors, jointly responsible for the payment of the revenue assessed upon the village lands. It is almost an invariable incident of the tenure, that if any of the proprietors wish to sell their rights, or are obliged to part with them in order to satisfy demands upon them, the other members of the same community have a preferential right to purchase them at the same price as could be obtained from outsiders. Throughout the greater part of the province, the organization of the proprietors of land into village communities has existed from time immemorial, and is the work of the people themselves, and not the result of measures adopted either by our own or by previous governments. Indeed, these communities have sometimes been strong enough to resist the payment of revenue to the government of the day; and before British rule nothing was more common than for them to decide their disputes by petty wars against each other, instead of having recourse to any superior authority to settle them. But in some localities the present communities have been constituted from motives of convenience in the application of our system of settlement.

Commerce, Trade, &c.—The great centres of trade in the Punjab are Multan, Lahore, Amritsar, Ambala, Delhi, and Peshawar. The channels of traffic fall into four great divisions. That on the north frontier comprises the trade with Kashmir, Ladakh, Yarkand, Chinese Tibet, and Central Asia generally; that on the west frontier includes the trade with Cabul, Tirah, and Siestan. By both these routes the traffic inward consists of *charas* (an intoxicating preparation of Indian hemp), dyes of various kinds, goat's wool, raw silk, fruits, and nuts, wood, furs and feathers, and shawl cloth; while indigo, grain, metals, salt, spices, tea, tobacco, Indian and European cotton cloth, hides, and leather, form the chief items of return trade. The imports on the south frontier, from Sind and Rajputana. But by far the largest trade is that by the eastern frontier with the north-western and central provinces, Bengal, Bombay, Oudh, Madras, and Rajputana. As the Punjab is essentially an agricultural country, the exports consist chiefly of grain, cotton, salt, and other raw produce; while the imports comprise cloth, hardware, and other manufactured articles. The mineral wealth of the province is almost confined to its rich deposits of rock-salt. The principal manufacture is that of cotton cloth. The railway system of the Punjab is a continuation of that which extends from Calcutta into the North-western Provinces, and has direct connection with the sea at Karachi (Kurrachee) in Sind. The East Indian Railway sends a branch across the Jumna at Delhi, whence the Rajputana State Railway runs southward through Delhi and Gurgaon districts into Rajputana, and will ultimately be extended to Bombay. The Sind, Punjab, and Delhi Railway continues the main system through the Gangetic Doab, crossing the Jumna into this province from Saharanpur district,

and runs *via* Ambala, Ludhiana, Jalandhar, and Amritsar to Lahore. Thence the Northern State Railway continues the line as far as Peshawar on the north-west frontier; while the Indus Valley Railway unites Lahore and Multan with Bahawalpur, Sukkur (Sakhar), and Karachi. A large part of the heavy traffic is conveyed by country boats on the five rivers, and thence by the Indus to the sea. Excellent metalled roads also connect the main centres of trade and the district headquarters.

The province is divided into ten divisions, namely, Delhi, Hissar, Ambala, Jalandhar, Amritsar, Lahore, Rawal Pindi, Multan, the Derajat, and Peshawar. The climate of the Punjab plains is noticeable for its dryness and heat. Near the hills the rainfall is comparatively high. The principal endemic disease is fever.

History.—In 1524 the Mogul Prince Babar invaded India, on the invitation of Daulat Khan Lodi, governor of Lahore, and succeeded in conquering the whole Punjab as far as Sirhind. Two years later he again swept down from Cabul upon Hindustan, defeated the Afghan army in a decisive battle at Panipat, entered Delhi as a conqueror, and founded the dynasty known to Europeans as that of the Great Mogul. Under that magnificent line the chief seats of the imperial family were at Lahore, Delhi, and Agra; and the Punjab formed the stronghold of the Mogul party against the reactionary Pathan house of Sher Shah. During the most flourishing age of the Moguls, however, a power was slowly and unobtrusively arising in the Punjab, which was destined in the end to supplant the imperial sway, and to raise up a great independent monarchy in the valley of the Five Rivers. This power was the Sikhs, originally a mere religious sect, founded by Baba Nanak, who was born near Lahore in the latter half of the fifteenth century, and who died at Dehra Nanak, on the Ravi, in 1539. Baba Nanak was a disciple of Kabir, and preached as a new religion a pure form of monotheism, eagerly accepted by the peasantry of his neighbourhood. He maintained that devotion was due to God, but that forms were immaterial, and that the Hindu and Mohammedan worshipers were the same in the sight of the deity. His tenets were handed down by a succession of Gurus or spiritual leaders, under whom the new doctrine made steady but peaceful progress. Ram Das, the fourth Guru, obtained from the Emperor Akbar a grant of land on the spot now occupied by the city of Amritsar, the metropolis of the Sikh faith. Here he dug a holy tank, and commenced the erection of a temple in its midst. His son and successor, Arjun Mall, completed the temple, and lived in great wealth and magnificence, besides widely increasing the numbers of his sect, and thus exciting the jealousy of the Mogul government. Becoming involved in a quarrel with the imperial governor of Lahore, Arjun was imprisoned in that city, where he died, his followers asserting that he had been cruelly put to death. "This act of tyranny," writes Elphinstone, "changed the Sikhs from inoffensive quietists into fanatical warriors. They took up arms under Har Govind, the son of their martyred pontiff, who inspired them with his own spirit of revenge and of hatred to their oppressors. Being now open enemies of the government the Sikhs were expelled from the neighbourhood of Lahore, which had hitherto been their seat, and were constrained to take refuge in the northern mountains. Notwithstanding dissensions which broke out among themselves, they continued their animosity to the Mussulmans, and confirmed their martial habits until the accession, in 1675, of Guru Govind, the grandson of Har Govind, and the tenth spiritual chief from Nanak. This leader first conceived the idea of forming the Sikhs into a religious and military commonwealth, and executed his design with the systematic spirit of a Grecian lawgiver. . . . But their numbers were inadequate to accomplish their plans of resistance and revenge. After a long struggle Guru Govind saw his

strongholds taken, his mother and his children massacred, and his followers slain, mutilated, or dispersed. He was himself murdered in 1708 by a private enemy at Nandair in the Deccan. The severities of the Mussulmans only exalted the fanaticism of the Sikhs and inspired a spirit of vengeance, which soon broke out into fury. Under Guru Govind's principal disciple, Banda, who had been bred a religious ascetic, and who combined a most sanguinary disposition with bold and daring counsels, they broke from their retreat and overran the east of the Punjab, committing unheard-of cruelties wherever they directed their steps. The mosques were destroyed and the *mullas* killed; but the rage of the Sikhs was not restrained by any considerations of religion, or by any mercy for age or sex. Whole towns were massacred with wanton barbarity, and even the bodies of the dead were dug up and thrown out to the birds and beasts of prey. The principal scene of these atrocities was Sirhind, which the Sikhs occupied, after defeating the governor in a pitched battle; but the same horrors marked their route through the country eastward of the Sutlej and Jumna, into which they penetrated as far as Saharanpur. They at length received a check from the local authorities, and retired to the country on the upper course of the Sutlej, between Ludhiana and the mountains. This seems at that time to have been their principal seat; and it was well suited to their condition, as they had a near and easy retreat from it when forced to leave the open country. Their retirement on the present occasion was of no long continuance; and on their next incursions they ravaged the country as far as the neighbourhood of Lahore on the one side, and of Delhi itself on the other." The emperor himself, Bahadur Shah, was compelled to return from the Deccan in order to proceed against the Sikhs in person. He shut them up in their hill fort at Daber, which he captured after a desperate siege, the leader Banda and a few of his principal followers succeeding by a desperate sally in effecting their escape to the mountains. The death of Bahadur Shah, in 1712, probably prevented the extermination of the sect. During the discussions and confusion which followed that event the Sikhs were allowed to recruit their strength, and they again issued from their mountain fastnesses and ravaged the country. In 1716, however, Abdul Samad Khan, governor of Cashmere, was despatched against them at the head of a large army by the Emperor Farrukh Siyyar. He completely defeated the Sikhs in several actions, took Banda prisoner, and sent him to Delhi, where he was put to death along with several other of the Sikh chieftains. An active persecution ensued, and for some time afterwards history narrates little of the new sectaries.

In 1738 Nadir Shah's invading host swept over the Punjab like a flooded river, "furious as the ocean," defeated the Mogul army at Karnal in 1739, and sacked the imperial city of Delhi. Though Nadir retired from India in a few months with his plunder, he had given the death-blow to the weak and divided empire. The Sikhs once more gathered fresh courage to rebel, and though again defeated and massacred in large numbers, "the religion" gained new strength from the blood of the martyrs. The next great disaster of the Sikhs was in 1762, when Ahmad Shah Durani, the Afghan conqueror of the Marhattas at Panipat in the preceding year, routed their forces completely, and pursued them across the Sutlej. On his homeward march he destroyed the town of Amritsar, blew up the temple, filled the sacred tank with mud, and defiled the holy place by the slaughter of cows. But, true to their faith, the Sikhs rose once more as their conquerors withdrew, and they now initiated a final struggle, which resulted in the secure establishment of their independence. By this means the religion had come to present very different features from those of Baba Nanak's peaceful theocracy. It had grown into a loose military organization,

divided among several *mishls* or confederacies, with a common meeting-place at the holy city of Amritsar.

The Moguls had nominally ceded the Punjab to Ahmad Shah; but the Durani emperors never really extended their rule to the eastern portion, where the Sikhs established their authority not long after 1763. The Afghan revolution in 1809 facilitated the rise of Ranjit Singh, a Sikh adventurer, who had obtained a grant of Lahore from Zaman Shah in 1799. Gradually this able chieftain spread his power over the greater part of the Punjab, and even in 1809 attacked the small Sikh principalities on the east of the Sutlej. These principalities sought the protection of the British—now masters of the North-western Provinces, with a protectorate over the royal family of Delhi—and an agreement was effected by which the states obtained the powerful aid of the British government. In 1818 Ranjit Singh stormed Multan, and extended his dominions to the extreme south of the Punjab; and in the same year he crossed the Indus, and conquered Peshawar, to which, shortly after, he added the Derajat, as well as Cashmere. The Maharaja of the Sikhs had thus succeeded during his own lifetime in building up a splendid power, embracing almost the whole of the present Punjab province, together with the native state of Cashmere. On his death in 1839, his son, Kharak Singh, succeeded to the throne of Lahore, but died, not without suspicion of poison, in the following year. A state of anarchy ensued, during which the Sikhs committed depredations on British territory, resulting in what is known as the first Sikh War, in 1845. It is impossible within the limits of this article to attempt more than a bare enumeration of the great battles of that and the subsequent war.

The bloody fights of Mudki (Moodkee), Ferozshah, Aliwal, and Sobraon insured the British victory, and terms of peace were dictated to the vanquished at Lahore. A council of regency was appointed during the minority of the young Maharaja Dhulip Singh (whose name is somewhat more familiar in the corrupt spelling, Dhualeep Singh), and a British resident took up his abode at Lahore.

In 1848, however, the rebellion of Mulraj at Multan roused a general revolt throughout the Sikh kingdom; till the victory of Gujrat (22nd February, 1849) reduced the Punjab to the condition of a British province. On 29th March, in the same year, the young Maharaja Dhulip Singh, transferred the sovereignty of his dominions to the East India Company, and accepted in return an annuity of £50,000 a year, with the condition that he should remain obedient to the British government, and should reside at such place as the Governor-general of India might select. His highness for long resided in England, where he purchased estates, married, and settled down as an English nobleman. However, in 1886 he attempted to revisit his native land, but was prevented from proceeding beyond Aden.

The Punjab, after being annexed in 1819, was first governed by a Board of Administration, and, after some intermediate changes, was erected into a Lieutenant-governorship. The headquarters of the lieutenant-governor were fixed at Lahore, and the new province was divided into districts upon the ordinary British model. Since that period the Punjab has made steady progress in commercial and industrial wealth. Canals have spread irrigation over its thirsty fields; railways have opened out new means of communication for its surplus produce; and British superintendence, together with the security afforded by our firm rule, has developed its natural resources with astonishing rapidity. During the mutiny of 1857 the country remained comparatively quiet; and, after the close of that great struggle, most of the districts on the western bank of the Jumna, including Delhi, were transferred from the North-western Provinces to the Lieutenant-governorship of the Punjab.

PUN'KAH, a large banner-like fan suspended in dwelling rooms in India, and moved to and fro by native attendants to keep the air of the rooms in motion, and thus to cool them. The word is the Hindustani for fan, *pankha*, literally a wing or feather, the Sanskrit *paksha*, wing.

PUNO, the loftiest town of Peru, being 12,870 feet above the sea level. The population reached 30,000 while its mines were productive, but is now much reduced. A railway has been completed from Arequipa and Islay on the Pacific coast, to this point on the high plateau.

PUNT (Dutch *pont*), a flat-bottomed boat, with broad square ends, chiefly used in shallow waters and for fishing purposes.

PUNTA ARENAS, a Chilean station and place of call for the Pacific steamers, situated on the Straits of Magellan. The climate is not healthy, and a landing is rarely possible more than once in every four or five days. Gold has been found in the vicinity. Here the Chileans, who claim sovereignty over Patagonia, maintain a convict station, and there is also a colony of Chileans and Swiss. It was in this part of the Strait that in 1881 the fatal explosion occurred on board H.M.S. *Doterel*, resulting in the destruction and sinking of the vessel.

PUNTAS ARENAS, or **PUNTA DE ARENAS**, a town in Central America, on the Gulf of Nicoya, in the Pacific. It is the principal seaport of the state of Costa Rica, and has a good and well-sheltered harbour, but the entrance is dangerous. There is excellent communication with the interior, and coffee is largely exported. The population is not large, and the climate is unhealthy, though less so than that of Caldera, which was formerly the port, but was abandoned on account of its insalubrity, and the settlement removed to Puntas Arenas.

PUNTORMO, **JACOPO DA**, was the ordinary name of *Jacopo Carucci*, derived from his birthplace, Puntormo in Tuscany, where he was born in 1493. He was the scholar of Andrea del Sarto, and, like his master, was an imitator and devoted admirer of Michelangelo. He was an excellent portrait painter, but his most important works were some frescos in the church of San Lorenzo in Florence, representing the Deluge and the Last Judgment. In the subsequent century these famous frescos fell, with all similar works, into discredit, and were whitewashed over. Puntormo died at Florence in 1558. His portraits are still highly esteemed. He was the master of Angelo Bronzino.

PUPA (Lat., a girl, or a doll) is the term used in entomology to denote the intermediate state of an insect between the larval and perfect condition. [See **LARVA**.] In some insects, those in which the metamorphoses are said to be incomplete, as the cockroaches, crickets, and bugs, there is no true pupal state, the insect being active from the time of its exclusion from the egg, and acquiring its wings in the course of numerous moults. In other insects, such as beetles and bees, the larva undergoes a metamorphosis at the period of its last moult, being inclosed in a skin, through which may be seen more or less distinctly, but still in a rudimentary condition, the parts of the perfect insect, the division of the body into head, thorax, and abdomen, the legs, antennæ, and wings. These pupæ are inactive and take no food, but they are capable of moving the parts of their body to a slight extent under irritation. In the moths and butterflies and some of the flies the pupæ are in a still more helpless condition, the limbs being closely applied to the body and inclosed in separate sheaths, while a horny case envelops the whole body. In these last the pupa is called a *chrysalis*, and only the abdomen is capable of bending a little. The pupal condition of an insect usually lasts for a considerable time, and this period of helplessness is passed in concealment in burrows in the earth, in holes of trees, or within a cocoon of silk spun by the larva before undergoing its metamorphosis.

PUPIP'ARA is a small section of the order **DIPTERA** or two-winged flies, comprising insects in which the eggs are hatched within the parent's body, and the larvæ are only extruded when they are about to become pupæ. Only a single larva is developed at a time. The head is sunk in the thorax, and the antennæ are immersed in cavities of the head. The wings are often rudimentary or wanting. All the members of the group are parasitic. It contains three families, Hippoboscidae, which includes the Forest Fly (*Hippobosca equina*), parasitic on horses; the Sheep Tick (*Melophagus ovinus*), and other species parasitic on birds and mammals; the Nycteribiidae or bat-lice, infesting bats solely; and the Brulidae, containing a single species, the Bee Louse (*Braula ceca*), with neither eyes nor ocelli, found on the thorax of the honey bee.

PUPIV'ORA is a tribe of insects of the order **HYMENOPTERA**. In this group the trochanter, the second joint of the leg, consists of two rings; the abdomen is attached to the thorax by a narrow stalk; the female is provided with a long ovipositor consisting of two long and delicately serrated bristles inclosed in a horny sheath formed of two valves. The larvæ have no feet, and most of them are parasitic on living insects. The typical family is Ichneumonidae, containing the **ICHNEUMON-FLIES**, in which the female deposits her eggs in or upon the bodies of other insects, especially the caterpillars of butterflies and moths. The **GALL-FLIES** (Cynipidae) deposit their eggs on different parts of plants, producing galls of various shapes, in which the larva is hatched. The other families, Evaniidae, Proctotrupidae, and Chalcididae, are parasitic in the larval state on the eggs or bodies of other insects.

PURANA (Sanskrit, literally "old," from *purā*, what has gone before), the title of a collection of religious works which embody the leading tenets of the Hindu religion. They are said to have been compiled by Vyasa, the author of the Mahabharata, but a critical examination of their structure and contents has indisputably proved that they cannot possess the "hoar antiquity" which the Brahmans would claim for them. The number of those now in existence is eighteen, and their names, in the order given, are the following:—(1) *Brahma*; (2) *Padma*; (3) *Vishnu*; (4) *Siva*; (5) *Bhagavata*; (6) *Naradeya*; (7) *Markandeya*; (8) *Agni*; (9) *Bhavishta*; (10) *Brahma-vaivarta*; (11) *Leaga*; (12) *Varaha*; (13) *Skanda*; (14) *Vamana*; (15) *Kurma*; (16) *Matsya*; (17) *Garuda*; (18) *Brahmanda Purana*. They are almost entirely filled with myths and allegories in reference to the minor gods and heroes of Hindustan, though some are of a cyclopedical character, and impart a variety of crude and often erroneous information in law, cosmogony, religion, and science. (See Wilson's translation of the "Vishnu Purana," in the collected edition of the works of that learned doctor, by Professor Rost, London, 1864.)

PURBECK BEDS, an alternating series of thin limestones, marls, and shales, typically developed in the Isle of Purbeck in Dorsetshire. They rest conformably upon the Portland Beds, and pass gradually upwards into the more sandy deposits of the Wealden. They are chiefly of estuarine origin, with few marine interstratifications, and were formed at the mouth of the great river in the delta of which the Wealden strata subsequently accumulated. Together with the Wealden they bear witness to a terrestrial episode in the British area, intervening between the marine conditions, under which the oolites beneath and the cretaceans above were deposited.

The Purbeck Beds, near Swanage, are about 360 feet in total thickness, and are well exposed in the cliffs of Durdlestone Bay and the numerous inlets further west. According to their contained fossils, Professor Edward Forbes has considered them capable of division into three groups—an upper, middle, and lower; but the characters of the strata themselves are similar throughout.

At the base of the Lower Purbeck are three successive surface soils, locally known as "dirt beds." They are well exposed in the Portland quarries, and have also been seen in the cliffs of Lulworth Cove. Scattered through the soil are numerous silicified stems of coniferous trees and cycads, and one peculiar fossil of this nature is known to the quarrymen as the "petrified birds' nest;" it is the compressed stem, with the bases of the leaves of an extinct cycad, *Mantellia nidiformis*.

The Middle Purbeck Beds contain a particularly interesting series of fossil remains. Besides countless myriads of Cyprides, which equally characterize the upper and lower divisions, and many typical genera of estuarine and freshwater Mollusca (e.g. *Planorbis*, *Lymnæa*, *Paludina*, *Cyclas*, &c.), there are also abundant remains of fishes and reptiles, and numerous traces of Mammalia. Fishes are represented by *Lepidotus*, *Microdon*, *Asteracanthus*, and others; chelonians, by *Pleurosternon*; lizards, by *Macellodus* and *Nuthetes*; and crocodiles, by *Goniopholis*, and a number of curious dwarf forms. The mammalian fossils consist of portions of skulls, lower jaws, and limb bones, and are confined to a small stratum about 4 inches thick. The first specimen was discovered by Mr. Brodie in 1854, and Mr. Beccles' subsequent researches led to the disentanglement of about twenty species, which have been described by Sir Richard Owen. All these animals are of very diminutive size, and have been compared with the living kangaroo rats of Australia. The most important genera are *Plagiaulax*, *Triconodon*, and *Spalacotherium*, and they probably fed upon the insects, of which abundant traces have been met with in the surrounding deposits. Another interesting stratum in the Middle Purbecks is the "cinder bed," which is an accumulation of distorted oyster shells—the exuviae of old oyster beds that were evidently affected by the small supply of salt water within their reach.

The Upper Purbeck is noteworthy on account of its yielding the celebrated Purbeck marble. Like the SUSSEX MARBLE, this rock is a hard limestone, composed almost exclusively of the shells of *Paludina fuviatorum*.

The working of the Purbeck stone forms an important industry in the neighbourhood of Swanage, the hills to the south and west being penetrated with numerous shafts and galleries, and large quantities of durable building stone being obtained in addition to the ornamental marble.

PURBECK, ISLE OF, a district of England, consisting of a peninsula in the south-east of the county of Dorset, between the south coast and Poole Harbour and the River Frome. It is about 12 miles long by 7 broad, and is traversed by a chalky ridge, rising to 650 feet, on the north side of which the land is heathy and on the south fertile. The valuable Purbeck marble is quarried here, and the work is carried on under the rules and customs of a curious trades' guild of a mediæval type. The Kimridge coal shales have an almost unique antiquarian interest from the fact that the harder and more even-textured varieties were the subject of an important local manufacture prior to the Roman invasion, which the Romans seem to have continued. It was employed for cups and similar vessels, but still more largely for ornamental purposes—beads, armlets, and bracelets. The waste discs of shale left by the turner have been found in large quantities, and from their imagined use as coin were long currently called "Kimridge coal money."

PURCELL, HENRY, the greatest of English musicians, was born in 1658, in Westminster. He lost his father when only six years of age, and soon afterwards was entered as one of the children of the chapel-royal under Captain Cook, then master; it is probable that he received some subsequent instruction from Dr. Blow.

Purcell was remarkable for precocity of talent. While yet a boy-chorister he composed more than one anthem; and in 1680 Dr. Blow resigned in his favour the post of

organist of Westminster Abbey. In 1682 he became one of the organists of the royal chapel, and there, as well as at the abbey, produced the numerous anthems which spread his fame throughout the country.

Purcell's first essay in dramatic music, when only nineteen, was his setting the songs, &c., in Nahum Tate's "Dido and Æneas," an operetta written for a boarding-school of celebrity. The music in Nat. Lee's "Theodosius, or the Force of Love," performed at the Duke's Theatre, in 1690, was his first work for the stage. In the same year he set new music to "The Tempest." In 1691 he composed the songs, &c., in Dryden's "King Arthur." In 1692 appeared Sir R. Howard's and Dryden's "Indian Queen," with Purcell's music. His music in D'Urfey's "Don Quixote" is remarkably appropriate and clever. He also wrote airs, overtures, and act-tunes for many dramas, among which may be mentioned Dryden's and Lee's "Edipus," "Timon of Athens," "The Fairy Queen," altered from "A Midsummer-night's Dream," and Dryden's "Tyrannic Love, or the Royal Martyr."

The three detached cantatas by Purcell are undeniable proofs of his fancy, energy, and deep feeling. He also composed many single songs and duets. After his death they were collected by his widow and published in two folio volumes, under the title of "Orpheus Britannicus," the second and best edition of which is now very rare.

Purcell died on 21st November, 1695. The tale that he caught a severe cold through being locked out by his wife, who was angry at the late hours he kept, is now generally discredited. He probably died of consumption. He was buried in the north transept of Westminster Abbey. The latest and best account of Purcell is that by W. H. Cummings (London, 1882).

PURCHAS, SAMUEL, a celebrated compiler of works of travel, was born at Thaxted, Essex, in 1577. He was educated at Cambridge, and was instituted in 1604 to the vicarage of Eastwood, in Essex. This position he resigned to his brother after holding it for a few years, and proceeded to London with a view to literary work. In 1615 he was incorporated bachelor of divinity at Oxford, having previously been collated to the rectory of St. Martin's, Ludgate, in London, and he afterwards became chaplain to Abbot, archbishop of Canterbury. In 1613 he published the results of his researches into the works of 1300 authors, in the form of a thick folio volume, entitled "Purchas his Pilgrimage, or Relations of the World, and the Religions observed in all Ages and Places discovered, from the Creation unto this present." This work reached a fourth edition in 1626, the latter issue being greatly enlarged and enriched with maps by Mercator and Hondius. In 1619 he issued his "Purchas his Pilgrim, or Microcosmus, or the Historie of Man," &c., in one vol. 8vo., and in 1625, "Purchas his Pilgrimages, or Relation of the World in Sea Voyages and Lande Travels by Englishmen and others," in four vols. folio, each volume containing five books. The latter work was partly founded on the MSS. of Hakluyt, and it was designed as a continuation of the latter's "Voyages." Purchas was also the author of "The King's Tower and Triumphant Arch of London," a sermon published in 1623, and of a funeral sermon on Psalm xxxix. 5 (8vo, 1619). He was an industrious and painstaking compiler, and his works contain stores of information, which have been freely drawn upon by later writers. His books, however, brought him no profit during his lifetime, and their publication involved him in debt, from which he was never able to extricate himself. According to some accounts he died in a debtors' prison, September, 1626, but Anthony Wood asserts that though he was involved in pecuniary difficulties he died in his own house.

PURFLING (Fr. *pourfiler*), a narrow string of inlaid work all round the back and belly of a violin, following

the shape a short distance from the edge. The purfling is made up of a strip of sycamore between two strips of ebony, and the three strips together may have a thickness of a little over a sixteenth of an inch. The strips being glued together, are bent round a frame, when softened by heat and moisture, till they have acquired the desired curve, and the triple strip is then inserted edgewise in the groove ploughed out to contain it, and afterwards levelled down to the surface of the violin. It not only serves to decorate the instrument very beautifully, but also to cut off any cracks or damage occurring at the edge, and so to protect the body of the instrument.

PURGATORY, according to the authoritative teaching of the Roman Catholic Church, is a temporary state of expiation, in which are detained, till by suffering they are rendered worthy to take their place in the ranks of the blessed in heaven, the souls of the just, who at death are stained with imperfections and lesser sins, or who have not yet satisfied the divine justice by completing the temporal punishment due for mortal sin, the eternal guilt of which has been remitted. Prayer for the souls departed, that the rigour and the duration of their sufferings may be lessened, is the necessary complement of this doctrine. These two points embrace the whole dogmatic declarations of the Catholic Church on the subject of purgatory. Questions beyond these, such as the nature of the sufferings, their duration, and the way in which departed souls are soled by the prayers of the living, are the opinions or deductions of theologians and preachers, which do not form part of the defined doctrine of the church, and are not to be accepted as of faith. The Council of Trent, after affirming the existence of purgatory and the efficacy of prayer for the dead to be an article of faith, strongly impresses on all bishops the duty of providing that, while the doctrine itself is sedulously taught, they do not permit preachers in popular discourses to put before the people mere opinions or speculative questions which tend only to gratify curiosity, and might lead to superstition or scandal.

To reproduce the scriptural and other arguments which Catholic theologians bring forward in proof of the doctrine of purgatory would be out of place in an article whose purpose is not controversy but simple exposition. The object of the article will be best served if the definition already given is followed up now by a brief explanation, which may throw some light on the doctrine itself, and also show how perfectly it fits in to the dogmatic system of the Catholic Church.

In justification the sinner is raised from a state of sin to the state of grace. Through the merits of Christ his sin is forgiven, grace is infused into his soul, and he is not merely accounted, but made a living member of Christ's body. He becomes really and personally sanctified, and his will is turned from evil and inclined to good. Yet both the freedom of his will and the infirmity of our fallen nature remain with him; so that he is liable to imperfections and faults, while yet his will is not turned away from God, nor the grace of his state of sonship lost. So imperfection and stain may continue till the moment when death summons the soul before the judgment-seat. The history of God's dealings with his creatures, from Paradise to Calvary, shows the Almighty inflicting on sinners temporal punishment for their sins. Now, sufferings both purify the soul and are expiatory of sin. In the furnace of affliction we are refined "as silver is refined;" and "whom the Lord loveth he chastiseth." Thus the prophet who, on the part of God, announced to David that his sin had been taken away, warned him at the same time that punishment for his forgiven sin was still due, and would be exacted in the death of his child. Even the justified are not, while in this life, "perfected in holiness." But death, which is the mere mechanical separation of soul and body, does not operate with sacramental power to purify or

change in any way the state of the soul as it goes before its judge. With imperfections then unexpiated, with a debt of chastisement for sin not yet paid, how shall the soul be made a citizen of heaven where nothing defiled can enter? How shall it, after death, be made perfect in holiness? The Catholic Church teaches that the expiatory fire of purgatory purifies and perfects the souls of the just after death, and her theologians claim the authority of St. Paul for her doctrine—"Now, if any man build upon this foundation gold, silver, precious stones, wood, hay, stubble, every man's work shall be manifest, for the day of the Lord shall declare it, because it shall be revealed in fire. . . . If any man's work burn he shall suffer loss, but he himself shall be saved, yet so as by fire" (1 Cor. iii. 12-15). The judgment finds blemishes in their life, which must be expiated ere they can obtain their crown; nevertheless they shall enter heaven, "yet so as by fire."

Now the state of the faithful departed is a matter of the deepest concern to their brethren whom they have left behind. All those who have been "baptized into Christ," we who are still struggling here against error and sin, together with those who, having remained faithful until death, are already triumphant in heaven, or suffering for a time in purgatory, are one body, intimately united in Christ, our head. Death does not undo the bond by which one faith united us all in life. In Christ we are still one with those departed. When, then, we think of the rigours of God's justice, and the anguish of that flame which it kindles to consume the "wood, hay, and stubble" of their imperfect works, the desire of our hearts rises spontaneously in prayer, that eternal rest and peace may be vouchsafed to the souls of the faithful departed. And the Catholic Church is in this faithfully following the unvarying practice of Christian antiquity. Every liturgy that has come down to us since the apostles' time contains forms of prayer for those who have gone to sleep in Christ. And the Christian church does but continue in her liturgies the doctrine of the synagogue on the subject, as it was professed in the time of our Lord, and had been handed down for ages. The well-known passage of the second book of Maccabees leaves absolutely no room for doubt on this point—"And making a collection he sent twelve thousand drachms of silver to Jerusalem for sacrifice, to be offered for the sins of the dead, thinking well and religiously of the resurrection. . . . It is therefore a holy and wholesome thought to pray for the dead that they may be loosed from their sins" (xii. 43-46).

PURGING or PHYSIC NUT (*Jatropha Curcas*) is a species of plant belonging to the order EUPHORBACEÆ, so called from its seeds being employed medicinally. It is indigenous in tropical America, but is cultivated in other warm parts of the world. It is a large shrub, or sometimes a tree, 20 feet high, much branched with large lobed leaves and small green monococious flowers. The fruit is globular and fleshy, of a black colour when ripe, and three-celled, each cell containing a single seed. The seeds contain an abundant acrid oil, which is expressed and used for burning in lamps and also medicinally, like castor oil. The seeds themselves are employed, either whole or pounded in a mortar, as purgatives. With Europeans they seem to generally produce injurious effects. The oil, boiled with oxide of iron, forms a black varnish used by the Chinese for covering boxes. The milky juice of the plant, applied to wounds, is said to have healing properties. Both the seeds and the expressed oil are imported into England.

PURI (commonly known as *Jagannath*) is the chief town of Puri district, Bengal, situated on the coast, in 19° 48' N. lat., and 85° 51' E. lon., separated from the sea by low sandy ridges. The ordinary resident population amounts to 25,000, but during the great festivals of Jagannath the number is sometimes swollen by as many

as 100,000 pilgrims. Puri covers an area of 1871 acres, including the whole *kshetra* or sacred precincts of the town. It is a city of lodging-houses, being destitute alike of manufactures or commerce on any considerable scale. The streets are mean and narrow, with the exception of the principal avenue, which leads from the temple to the country house of Jagannath. The houses are built of wattle, covered with clay, raised on platforms of hard mud, about 4 feet high, and many of them gaily painted with Hindu gods, or with scenes from the Indian epics. The intervening sandhills between the town and the beach intercept the drainage, and aggravate the diseases to which the overcrowding of the pilgrims gives rise. The sanitary measures which have been taken for the improvement of the town are of three kinds—the first directed to lessen the number of pilgrims; the second, to mitigate the dangers of the road; and the third, to prevent epidemics in the town. A description of the festival is given in the article JAGERNAUT.

PURIFICATION. Rites and ceremonies of a purificatory character have from the earliest times formed an important element in most of the great religious systems of the East. The ancient Egyptians had many observances of this kind, and so had the ancient Persians and Hindus. Some of the Persian customs are still retained by the *Parsees*, and purificatory rites of an elaborate character form a prominent feature in the various modes of worship now prevailing in India. Among the ancient Hebrews the laws relating to purification, though less minute and harassing than those of the Hindus, were yet of an elaborate character. By the terms of the Levitical legislation several distinct grades of uncleanness were marked out, to each of which appropriate purificatory rites were appended. The lesser degrees of uncleanness, such as were caused by the exercise of the sexual function, the touching or carrying of the carcase of an unclean beast or of a clean beast which had died a natural death, &c., could be removed by simple ablution of the person and clothes, but the higher degrees required sacrificial expiation also (Lev. xi.-xv. &c.) In some cases a period of seclusion was enforced in addition to the ceremonies of cleansing; thus a woman after childbirth was considered impure, and forbidden the sanctuary for a space of forty days if delivered of a male, and eighty if of a female child, the close of the period being marked by the offering of a sacrifice. Touching a dead body or a grave entailed a period of seclusion lasting seven days and the use of a special wash or sprinkling, made by mingling the ashes of a heifer with water. For the priests purificatory rites of a still more elaborate kind were enjoined, and the necessity of purification was extended during the closing century of the pre-Christian period to a variety of cases not mentioned in the written law. In Mark vii. 1-23, we have an account of a controversy between Jesus and some of his opponents of the Pharisees respecting the necessity of some of these observances, a brief explanatory note for Gentile readers being inserted (verses 3 and 4) by the compiler. In the Christian church, with the exception of the sacrament of baptism, purificatory rites do not occupy a prominent position. In Mohammedanism they are considered to be of great importance, minor ablutions being required as an invariable preliminary to worship, and more elaborate cleansings being enjoined for special occasions.

PURIM is the name of an annual Jewish festival, which dates from the connection with Persia. According to Jewish tradition it was instituted to commemorate the deliverance of the Hebrews from the persecution of Haman by the virtues of Mordecai and the influence of Esther, but some modern scholars regard it as an adaptation of a Persian festival, and derive the name Purim from the Persian *Furdigan* (*Pordigan*, *Pordiyun*). It appears to have only gradually made its way among the Jews, but

Josephus declares that it was generally observed at his period. The modern observance of the feast falls on the 14th and 15th of Adar, a preliminary fast being observed on the 13th, except when the latter falls upon the Sabbath. The ceremonies of the feast include attendance at the synagogue, where the Book of Esther and the section about Amalek (Exod. xvii. 8, *et seq.*) are read in a histrionic manner by the reader, the congregation responding with curses for the enemies of Israel, for Haman, for Zeresh his wife, and for all idolaters, and with blessings for Mordecai, Esther, the hangman of Haman, and for Israel. The rest of the time is passed in merry-making of a secular character, and formerly a free indulgence in wine was considered pardonable on the feast of Purim.

PURITANS, a name first given, according to Fuller, about 1561, to such clergymen of the Church of England as declined to subscribe to the liturgy, ceremonies, and discipline as arranged by the bishops under the direction of Archbishop Parker. The clergymen so called desired a form of worship more simple and *pure* than they believed that of the church as then established to be. They were called Puritans probably out of derision, and the name was shortly applied to the laity as well as the clergy. To understand the nature of Puritanism, it must be remembered that at the Reformation the constitution of the Anglican Church was arranged by Crammer and his coadjutors on an elaborate system of compromise. Henry VIII. in breaking away from Rome had no intention of introducing Protestantism, his designs being limited to the transference of the papal supremacy to himself, and the appropriation of the vast property which had been gradually acquired by the conventual and monastic establishments of the country. He was compelled by the force of circumstances to ally himself with Protestantism, but the alliance was made unwillingly, and changes in ritual, &c., were minimized as much as possible. Further modifications of the doctrines and worship of the church were introduced under Edward VI., and after the reaction under Mary, the work was further completed by the Episcopacy during the reign of Elizabeth. To the more ardent reformers, however, the changes introduced seemed quite inadequate, and the new wine of the Reformation could not be retained by the old bottles of the church. Elizabeth, though in some aspects the champion of Protestantism, was in her home policy most anxious to maintain the royal supremacy, and she looked with intense disavour on all who declined to be bound by the doctrines and practices enjoined by the state. Hence we find her reign stained with persistent and cruel persecution of all those who refused to obey the Episcopal ordinances; but in spite of the persecution it was during the period of Elizabeth that the sect of the Independents first arose and the first Presbyterian congregation was established in England. The policy of repression was continued by James I., but Puritanism continued to grow and increase among the English people, and matters reached a crisis in the reign of his successor Charles I. At first, owing to the resolute and cruel tyranny of Land, Puritanism seemed likely to be deprived of all influence and power, and then along with the uprising of the national might against the despotism of the king, it gained the ascendancy, and the fall of the king involved for a time the Episcopal organization of the church as well. Previous to the Commonwealth we may notice the existence of three distinct parties in Puritanism:—(1) That of the Moderates, those who were content with the Episcopal organization, but who desired reform within the church; (2) the Presbyterian or Calvinistic party, who wished to abolish Episcopacy in favour of an organization on the Genevan model; and (3) the Independents, who were opposed to the existence of a national church of any kind. For the history of the parties subsequent to the Commonwealth see under CONGREGATIONALISM and PRESBYTERIANISM. The

Restoration brought with it the ascendancy of Episcopalianism and forced the Puritans out of the Anglican fold, henceforward to lead a chequered existence as Dissenters.

During the persecution under James I. and Charles I. many of the Puritans sought refuge in America, and the New England States were formed by immigrants of this character. In the early history of these states we may see exemplified some of the brightest virtues of Puritanism, fidelity to truth, courage, patience, endurance, devotion, and unflinching confidence in God; but, unhappily, we see also much of its evil side, in the harsh narrow laws enforced upon all, and in the institution of fierce measures of persecution against all who, like the Quakers and Unitarians, refused to accept the doctrines laid down by the Puritan divines.

See Burnet's "History of the Reformation" (1679 *et seq.*); Strype's "Ecclesiastical Memorials" (second edition, 1725-37); Neal's "History of the Puritans" (1732 *et seq.*); Hallam's "Constitutional History of England" (1867); Macaulay's "History of England" (1848 *et seq.*); Gardiner's "First Two Stuarts and the Puritan Revolution" (1876); and Bayne's "Chief Actors in the Puritan Revolution" (1878).

PURKINJE'S FIGURES. See RETINA.

PURL was the name given to a beverage formerly very popular, but now very little used, made by adding bitters and spirit to warm ale. Sometimes a sweet purl was made by the addition of a little milk, sugar, and spirit to the ale, but the bitter purl was the favourite on account of its tonic qualities.

PURPLE EMPEROR (*Apatura iris*) is a species of BUTTERFLY belonging to the family Nymphalidae. The purple emperor is the most magnificent of British butterflies. In the male the upper surface of the wings glows with a rich changing purple, spotted and barred with white, the corresponding colour in the female being dark brown. The wings in expanse measure from 2 to 3½ inches, being largest in the female. The male is remarkable for his powerful flight, making his throne on the tops of the loftiest trees. For this reason collectors would find it very difficult to capture him, but that he can generally be enticed to lower ground by the presence of carrion. The female is seldom seen on the wing. The perfect insect chiefly haunts oaks, but the caterpillar, which is bright green with yellow stripes on the sides and a pair of horns on the head, feeds chiefly on the sawfly. In this country the purple emperor is found chiefly in the oak woods in the south-east of England. It is common in Central Europe.

PURPLE, VISUAL. See RETINA.

PURPURA OR THE PURPLES, the name given to a disease characterized by the appearance of an eruption on the legs, arms, trunk, and in severe cases head and face, of isolated spots whose colour varies from bright red to dark purple. These spots are generally round or irregular in shape, having uneven and denticulated edges; they are not raised above the skin, are not accompanied by pain, and do not disappear upon pressure. In ordinary cases their size varies from that of a pin's head to that of a bean, but sometimes they form patches several inches round. They are caused by an extravasation of blood beneath the cuticle, and in consequence they undergo the same changes of colour that a bruise does before disappearing. The latter circumstance should always be borne in mind in connection with forensic medicine, as serious mistakes may be made. In a case which came under the writer's notice a worthy man had to endure much undeserved odium and had his prospects for life seriously clouded through certain purpura patches observed after a sudden death being mistaken for bruises. Similar effusions to those between the skin are in severer cases found beneath the mucous membranes, and these, owing to the thinness of

the membranes, are generally attended by passive hæmorrhages, the blood flowing from the mouth, nose, bowels, urinary tract, &c. The disease is usually attended with debility and a tendency to faintness, with loss of appetite, but this is not an invariable rule; and the same may be said of other symptoms, such as a slight fever or rheumatic pains in the knees and ankles.

The causes of the complaint are very obscure, and the mode of treatment varies in different cases. In simple and rheumatic cases the prognosis is favourable, rest in bed, attention to the digestive organs, and the use of quinine and iron being generally sufficient to effect a speedy cure. Where the disease takes the form of copious bleedings it is more dangerous, and it calls for the use of ergot, turpentine, gallic acid, and other drugs which have power in controlling the discharge of blood. Where there is severe hæmorrhage from the bowels injections of iced water may be found useful.

PURPURIC ACID. This acid has never been isolated, but a number of its salts are known. The most important is the purpurate of ammonium, or murexide. This beautiful substance is dichroic; it crystallizes in four-sided prisms, garnet red by transmitted light, and golden green by reflected light. The formula of this salt is $C_{12}H_6N_6O_6$ or $C_6H_3(NH_4)_2N_3O_3$; the formula of the acid, therefore, is calculated to be $C_6H_3N_3O_3$. It is insoluble in alcohol and ether, sparingly soluble in cold, very soluble in hot water, forming a splendid purple solution. Murexide was formerly much used in dyeing and calico printing; various brilliant shades of red, purple, and yellow are obtained, but these are now superseded by the aniline colours. The mixture with mercuric salts gives red and purple, that with zinc salts orange and yellow—all bright colours and not liable to fade, but easily tarnished by sulphurous acid. Potassium purpurate ($C_6H_3KN_3O_3$) is a red crystalline powder, soluble in water. There are many other purpuric salts, all having a deep purple colour in solution.

PURPURIN, a red colouring matter obtained from madder with alizarin, from which it differs by its solubility in aum liquors. It is obtained from these solutions by precipitation with dilute sulphuric acid. It is soluble in water, alcohol, and ether, and crystallizes in orange coloured needles, having the formula $C_{10}H_6O_4 \cdot 2H_2O$. $C_{10}H_6O_4$ represents anhydrous purpurin, a red powder. It is a deep and permanent red dye, resembling alizarin, but deeper in colour. By the action of ammonia it is converted into purpurein, or purpureamide ($C_{20}H_{12}N_2O_6$), a substance crystallizing in crimson needles, having a green reflection; it resembles murexide. It is soluble in hot water, alcohol, and the alkalis with deep violet colour.

PURSE, a Turkish money of account. By the monetary law of 1844 a purse consists of 500 Turkish piastres, and is therefore worth £4 10s. 3½d. The Egyptian purse is also of 500 piastres, but these are tariff piastres, and of greater value than the Turkish piastres; the Egyptian purse is therefore worth £5 2s. 6½d.

PURSLANE (*Portulaca*) is the typical genus of the order of plants PORTULACÆ. The species are low succulent herbs found in the warmer parts of both hemispheres. The Common Purslane (*Portulaca oleraceæ*) has been cultivated from very early times, and is now found in most parts of the temperate zone. Purslane was formerly more used than it is at present, at least in this country, in salads, as a pot-herb, in pickles, and for garnishing. It is considered to be very cooling, and hence in warm countries is more esteemed. It possesses antiscorbutic properties. The purslane is a prostrate annual about 6 inches long, with small oblong wedged leaves, and small solitary or clustered yellow flowers on the tops of the branches. Three varieties are cultivated in gardens, the green, the golden, and the large-leaved golden.

PURSUIT (Emotion of). See PLOT-INTEREST.

PUR'SUIVANT (Fr. *poursuivant*, follower) is the third and lowest order of heraldic offices, and was instituted as a novitiate through which intending heralds and kings-at-arms must first pass. The Herald's College of England possesses four pursuivants: *Rouge Croix*, *Rouge Dragon*, *Blue Mantle*, and *Portcullis*. The heraldic establishment of Scotland has six pursuivants, severally designated *Ding-wall*, *Bute*, *Carrick*, *Ormond*, *Kintyre*, and *Unicorn*: these take precedence according to seniority in office. In the olden time the barons appointed their own pursuivants: the dukes of Norfolk had one, *Blanch-lyon*; the dukes of Northumberland one, *Esperance*; and Richard Cecil, earl of Salisbury, one, *Egle Vert*. In 1442 we find a knight, Sir John Lisle, creating a pursuivant, *Blanch Sauglier*.

PURVEYANCE, a prerogative formerly enjoyed by the King of England of purchasing provisions and other necessities for the use of the royal household, and of employing horses and carriages in his service in preference to all other persons, and without the consent of the owners. The persons who acted for the king in these matters were called purveyors. A privilege of the same nature was also exercised by many of the great lords. The parties whose property was thus seized were entitled to a recompense; but what they received was inadequate, and many abuses were committed under the pretext of purveyance. About forty statutes were passed upon the subject, many of them, like all the important early statutes, being a re-enactment of those preceding. Purveyance was not formally abolished till after the Restoration. By the 12 Car. II. c. 24, this branch of the prerogative was surrendered by the king, who received in lieu thereof a certain amount payable on excisable liquors.

PUSEY, EDWARD BOUVERIE, D.D., was born near Oxford in 1800. He came of a Huguenot family, the leading members of which, originally named Bouverie, became a few years after his birth lords of the manor of Pusey, a village of Berkshire, the name of which they adopted. He was educated at Eton and Christ Church College, Oxford, where he took a first class in classics in 1822, and in 1824 was elected a fellow of Oriel. In 1828 he was appointed canon of Christ Church and regius professor of Hebrew, appointments which he held for the rest of his life. In the same year he published his first work of note, entitled "An Historical Inquiry into the probable causes of the Rational character lately predominant in the Theology of Germany," a book which contained a very fair and impartial account of the history of German theology subsequent to the Reformation. A second part of this work, displaying a very liberal tone of thought, appeared in 1830, but during the next two or three years he became associated with Keble, Newman, and the other leaders of the celebrated "Oxford movement," and soon made common cause with them. He contributed to the celebrated "Tracts for the Times," writing Nos. 18, 66, 67, and 69, the most famous being No. 67, entitled "Scriptural Views of Holy Baptism." In 1843 he preached before the university the first part of a sermon on the subject of "The Holy Eucharist—a Comfort to the Penitent," the doctrines of which appeared so startling to the university authorities as to cause them to suspend him for three years from the function of preaching. The effect of this step was the placing of Pusey at the head of the new religious movement, which for many years afterwards bore his name—Puseyism—though this was never accepted by its adherents. Eighteen thousand copies of the sermon that caused the excitement were sold, and when the suspension came to an end Pusey quietly resumed from the same pulpit the interrupted thread of his discourse. From this period to the end of his life he laboured unceasingly to promote the progress of Anglo-Catholicism, his activity both in public and private being enormous. He ever maintained that his position was quite consistent with membership in the Church of England, and

though many of his followers went over to Rome, his influence was always exerted in the opposite direction. In addition to numerous sermons and controversial letters and pamphlets, he published two books on the Eucharist—"The Doctrine of the Real Presence," in 1855, and "The Real Presence . . . the Doctrine of the English Church," in 1857; "History of the Councils of the Church" (1857); "Daniel the Prophet," an elaborate defence of the traditional view of the origin of this book; "The Minor Prophets, with a Commentary," in six parts (1862-77); an Eirenicon, in 1865, in which he endeavoured to find a basis of union between the churches of England and Rome; and he also contributed some valuable translations and prefaces to the "Library of the Fathers," begun by Newman, Keble, and Marriott in 1836.

In his private life he was quiet and retiring, limiting his society to his family and a few intimate personal friends, who revered him for his high intellectual gifts, his earnest piety, and his munificent charity. He lost his wife, after eleven years of married life, in 1839, and his only son died in 1880. He died, after a short illness, 16th September, 1882, and was buried in the cathedral of Christ Church.

PUSH'KIN, ALEXANDER, the most eminent of the poets of Russia, was born at Moscow, 7th June, 1799, being a descendant on the father's side from an ancient family of boyars, and on the mother's side from Annibaloff, a favourite negro ennobled by Peter the Great. In 1811 he entered the Imperial Lyceum of St. Petersburg, then situated at Tsarskoe Selo, where he remained six years, studying in a desultory manner, and attaining to no academical distinction. On quitting the Lyceum in 1817 he entered the foreign office, and immediately obtained a position in the highest circles of Russian society. Three years passed in the whirl of fashionable life had no inconsiderable influence upon the tone of his poetry, but in 1820, in consequence of a very daring "Ode to Liberty," he was compelled to accept an official position at Kishineff in Bessarabia in Southern Russia. During the next five years he led a wandering, unsettled life, writing "The Prisoner of the Caucasus" in 1822, and "The Fountain of Bakhchisarai" and "The Gypsies" in 1824. These romantic poems were read with avidity by his countrymen, and they aroused in Russia an enthusiasm similar to that created by Lord Byron in England. In 1825 he published his tragedy "Boris Godinoff," and soon after this he was enabled to make his peace with the government and obtain permission to reside in any part of the empire. In 1828 he published the narrative poem "Poltava," one of the best of his works, and in 1829 a collected edition of his poems. In 1831 he married a beautiful woman, Mademoiselle Natalia Goncharoff, and the following year he was again attached to the ministry of foreign affairs, receiving a liberal salary for his services. During the next three years he published a history of the rebellion of the Cossack Pugacheff, some prose tales, and the poem "Eugene Onegin," which may be considered his masterpiece. His position as poet and prose writer was now fully established, and his fame was rapidly extending, when his brilliant career was suddenly cut short by a most untoward event. He appears to have been somewhat unreasonably, offended by some attentions paid to his wife by the Baron George Hecheren d'Anthès, the illegitimate son of the Dutch ambassador, and his jealousy led to a duel on 8th February, 1837, in which Pushkin was mortally wounded. He died two days afterwards, leaving a widow and four children, who were provided for by the Emperor Nicholas. A complete edition of his works, in six vols., was published in 1859-60.

PUSS MOTH (*Dicranura vinula*) is a species of British MOTHS of the family Notodontidæ, so called from the soft downy hair covering the body. It measures nearly 3 inches in expanse of wing. The upper surface of the wings in both sexes is grayish, with numerous black lines

on the fore pair. The caterpillar presents an extraordinary appearance. It is of large size, with a large retractile head and a tail of two long horns, from each of which on irritation a slender scarlet thread is protruded. In colour it is bright green, with a darker patch on the back bordered with white. The caterpillar feeds on the willow, and forms a very hard projecting cocoon in the bark of the trunk, between 2 and 4 feet from the ground. The puss moth is common in this country. Three rarer species of the same genus are also found in Britain, called "kittens" by collectors. They are smaller than the puss moth, and feed on the willow and poplar.

PUTCHUK is the name by which a fragrant root is designated in the price-currents of Calcutta and Bombay, whence it is exported to Canton, being highly esteemed by the Chinese as an incense. It is the root of a plant belonging to the order *COMPOSITÆ* (*Aptaraxus Lappa*), which is a native of high elevations in Cashmere. It is a gregarious herb, 6 or 7 feet high, with an annual stem, large leaves, and sessile purple flower-heads. The root, which was known to the ancients under the name *Costus*, is thick, fragrant, warm, and aromatic in taste. According to Dr. Falconer the roots are dug up in September and October, and exported in pieces from 2 to 6 inches long, by way of Bombay, to China, the Red Sea, and the Persian Gulf; part is sent overland to Calcutta. The Chinese use the root as an aphrodisiac, and also burn it as incense; in Cashmere it is used for protecting bales of shawls from moths.

PUTEAL, a fountain rim or basin, was the name given by the ancient Romans to the short hollow shafts of brickwork which were the tombs of the lightning, and which looked like the basins of fountains. A round puteal, resting on eight Doric columns, has been excavated at Pompeii. The Romans considered that lightning died when it struck the earth, and had to be buried just like any other dead thing, whence the puteal. It was inscribed *fulgur conditum* (lightning buried here), that there should be no mistake.

PUTEOLI. See *POZZUOLI*.

PUTREFACTION. See *ANTISEPTICS*; *DECOMPOSITION*.

PUTTY (Fr. *potée*), the useful cement used by glaziers for fastening the glass in the frames of windows, is composed of linseed oil and whiting, well worked together by pressing and beating. It becomes remarkably hard in time, and fixes the glass irremovably. It is also used by painters for filling up holes and cavities in surfaces, previous to their being painted with oil colours.

PUY-DE-DÔME, a department in France, formed out of a portion of Auvergne, bounded N. by the department of Allier, E. by that of Loire, S. by those of Haute-Loire and Cantal, and W. by those of Creuse and Corrèze. Its greatest length, from north-west to south-east, is 85 miles, and the average width is about 50 miles. The area is 3078 square miles; the population in 1881 was 566,064.

Surface.—The surface presents an extensive undulating basin inclining generally towards the north, drained by the Allier, and shut in on the east and west by two chains of volcanic mountains resting on a granitic base. This basin, which is distinguished by the name of La Limagne, consists of the valley of the Allier, into which a great number of others open on either side, each furrowed by a stream that descends from the neighbouring mountains, and separated from the adjacent one by gently sloping hills. The Limagne has a soil which consists of decomposed volcanic matter mixed with alluvial deposits; it is exceedingly fertile and well cultivated; the hill sides are covered with vineyards and orchards; the rows of walnut trees that bound the fields, and the chestnut plantations, with their masses of foliage, add richness and variety to the landscape, which presents at every turn some new beauty. The chief products of this basin are wheat, hemp, wine, oil, and

fruits; there is some fine pasture land, and a great breadth of rich meadow, especially near Riom, which is flooded every year and yields three crops of hay.

Mountains.—The mountains of Forez, which bound the Limagne on the east, are an offshoot of the Cévennes; they form the watershed between the Allier and the Loire, and are covered with pine forests interspersed here and there with some poor pastures, and a few cultivated patches that yield only oats and rye.

The western boundary of the Limagne is formed by that portion of the Auvergne Mountains which runs northwards out of the department of Cantal, and forms part of the watershed between the Garonne and the Loire, including the two remarkable volcanic groups of the Monts Dômes and the Monts Doros. The common base of these mountain groups is 1968 feet above the mean level of the Limagne. The Monts Doros or Monts d'Or are in the south of the department, and consist of a great number of high peaks, the loftiest among which, called De Saucy, has an elevation of 6196 feet above the level of the sea. The peak De Saucy is covered on all sides with bare rocks, lava streams, and other volcanic products. This mountain mass is visible from Montauban, in the department of Tarn, a distance of 127 miles; and the view from the accessible summits is of a most extensive range, reaching even to the Alps. On the north-western slopes of the Monts Doros rise the two streams that give origin to the Dordogne, which river drains the south-western angle of the department. The Monts Dômes group lies more to the northward, a few miles west of the city of Clermont-Ferrand. It is famous for its picturesque beauty, and presents above forty conical peaks with extinct craters, locally called *Puys* (a name here given to the truncated cones of the extinct volcanoes of Auvergne, possibly in reference to the *puil*, a well or vent of the crater), lava streams that seem but just arrested in their course, basaltic columns in every variety of position, and frightful ravines, the sides of which show the agency that reared these stupendous masses. Far above all the other peaks rises the majestic cone of the Puy-de-Dôme, which gives name to the department, and though almost bare of trees forms an object of grand and striking beauty, being covered with brilliant verdure in all its vast dimensions, from base to summit, except in a few places where some rude protuberances and hideous chasms display the volcanic origin of the mountain. Although its crest is 4805 feet above the sea-level it is easily accessible, and presents in clear weather a view perhaps unequalled for extent and variety. Standing on this lofty elevation the spectator beholds countless herds of cattle and sheep feeding all round the grassy slopes of the Puy; a little further a vast number of conical peaks yawning with craters, some of which contain water; further south and west, the Auvergne ranges, extending into the departments of Corrèze and Cantal, and inclosing between them the valley of the Upper Dordogne; away to eastwards and northwards the whole basin of the Limagne with its towns, villages, and hills, its fields of every hue, its vineyards, isolated homesteads, rivers, and highways, all spread out before him as in a map or picture. The Puy-de-Dôme is connected with the history of the barometer, Pascal's test of the Torricellian theory having been satisfied by carrying the instrument to the top of this mountain. [See *BAROMETER*.] The basement and lower slopes of all these mountains abound in excellent pasture and in medicinal and aromatic plants. Hot and cold mineral springs exist at several points, the most famous being the hot springs of Mont Dore-les-Bains, near the source of the Dordogne. The mountains above described present the finest ancient volcanic mountain scenery in Europe; but the views among the Monts Doros and the Monts Dômes differ in this—that the latter, in addition to other attributes of sublimity, generally unite grace of outline with massive grandeur, while the former

inspire the beholder with a feeling of dismay by their appearance of ruin, destruction, and naked desolation. Many of the inhabitants of these sterile parts emigrate every year, and the population of the department is consequently decreasing.

The climate is not uniform. In the Limagne the summer is very hot, and the winter of short duration; the thermometer reaching 86° Fahr. in the shade in the former season, and sometimes as low as 5° in the latter. On the mountain slopes, above the region of vines, where only oats and hardy grains are grown, the winter and springs are cold; the high mountains, which are adapted only for summer pasture, have a long winter, the intense cold lasting from December to the end of February. The western range of mountains is subject to terrible hurricanes. The prevailing winds are the south-west and north-west.

The principal rivers are the ALLIER and its feeders, the Dore and the Sioule, which drain the eastern and north-western districts respectively; the DORDOGNE; and the Ane, a small feeder of the Loire, which flows south, draining a small strip on the extreme south-east of the department. In the west there are several small lakes, and also many beautiful waterfalls.

Products and Resources.—The corn products of Puy-de-Dôme exceed the consumption; chestnuts, hemp, apples, pears, cherries, apricots, and other fruits are grown in great abundance. The principal forests are in the arrondissements of Thiers and Ambert; they contain pine, oak, and beech. Horses are small. Cows are very numerous; a

good deal of fine cheese and butter is made, and many cattle are fattened. There are immense numbers of sheep, but of inferior breed. Among the wild animals are boars, roebucks, wolves, foxes, deer, hares, eagles, and vultures.

The department is rich in minerals—coal, antimony, silver, alum, lead, iron, copper, zinc, and marble being among its productions. Coal mines are worked in the north-west near Montaignu; and also at several points on the left bank of the Allier, by which river the coals are forwarded to Paris and Orleans. Almost all the towns are built of volcanic substances; and for buildings and paving purposes there are numerous quarries of lava, trachytic rock, basalt, pumice, besides granite, limestone, and bitumen. The lava quarries of Volvic, near Riom, are especially to be noted.

The manufactures are not very important. The commerce is composed of the various agricultural products before named, and of wines, confectionery, hides, paper, hempseed, nut-oil, deal planks, cattle, wool, coal, &c.

The department is divided into the five arrondissements of Clermont (containing the chief town, CLERMONT-FERRAND), Ambert, Issoire, Riom, and Thiers.

PUY, LE, a town of France, the capital of the department of Haute-Loire, and formerly that of the district of Yvelay, is situated at the foot and around the southern slope of a steep hill, at the junction of three pretty valleys, watered respectively by the Loire, the Borne, and the Dolaison, 270 miles S.E. of Paris, and 66 miles S.W. from



Le Puy.

Lyons, and had 18,567 inhabitants in 1881. Except the street at the foot of the hill, through which the roads from Clermont and Lyons run, the rest of the town is built in the form of an amphitheatre round the steep sides of Mont Anis, which is surmounted by a lofty basaltic rock called Cornielle, crowned by a colossal figure of the Virgin cast from cannon taken at Sebastopol. From a distance Le

Puy presents a most picturesque appearance; but the interior view disappoints the expectations thus raised. The streets are irregular, narrow, and in the upper part of the town inaccessible to carriages; they are paved with volcanic breccia, which in all weathers is slippery and dangerous to walk upon. The most important structures are—the Cathedral, situated in the highest part of the town; the

Church of St. Laurent, situated at the foot of the hill, and containing the monument and part of the remains of Du Guesclin; the prefect's residence, in the spacious square of Du-Breuil; the college church; the museum, near the cathedral, in which are numerous paintings, Roman antiquities, and one of the best collections of geological and mineralogical specimens in France; the theatre, an ancient structure, supposed to have been a heathen temple; and the Parnassic gate, a fine specimen of military architecture over one of the promenades of the town. Le Puy contains tribunals of first instance and of commerce, a consultative chamber of manufactures, a college, a public library, and various literary and scientific societies. In the suburb De l'Aiguille is an isolated basaltic rock of pyramidal form, and 285 feet high, which is ascended by a staircase of 218 steps cut in the rock, and is surmounted by the highly-ornamented chapel of St. Michel, erected in the tenth century. Between this rock and that of Corneille stands a heptagonal building, said to have been a chapel dedicated to St. Clair. The chief industrial products of Le Puy are lace, coarse woollens, wine-skins, nails, and leather; the commerce is in these articles, and in corn, iron, pottery, cattle, &c.

PUZZUOLANA, so-called from its being largely obtained at Puzzuoli, on the Bay of Naples, is a fine volcanic ash having the property of rapidly setting, like concrete, when mixed with water. Since the days of ancient Rome it has been extensively employed as mortar, and is the material from which **ROMAN CEMENT** was originally manufactured. The process of hardening depends upon the fact that ordinary water contains a small proportion of carbonic acid, and this acts on the lime in the volcanic fragments, producing carbonate of lime and free silica, which serve as cementing material. Frequently the natural ash does not contain a sufficient percentage of lime for complete consolidation, and in this case a certain amount of calcined limestone is added and thoroughly mixed.

PYCNOGONIDÆ. See **PODOSOMATA**.

PYGMALION (Gr. *Pugmalion*), in the Greek mythology, was a king of Cyprus who was a skillful sculptor. He once made a statue of the nymph Galatea of such surprising beauty that he fell in love with it, and suffered much through his strange passion. At last Aphrodite took pity on him and breathed life into the statue, who now reciprocated the love of her creator, and bore him a son, Paphos. The subject is a favourite one with poets and artists of all kinds, and is often put upon the stage on account of its inherent dramatic force.

PYGMY (Gr. *pygmaios*, dwarfish), a fabulous race of diminutive human beings, only a span high, who were supposed by the ancients to dwell on the River Nile. Homer describes a nation of pygmies as constantly at war with the cranes, which defeated them every spring. According to other authorities they inhabited the Indian Islands, India itself, Ethiopia, and Transgaugeitic India. The fables probably arose in some traveller's account of the Malayan and African apes, or of the low-caste races, puny and feeble, which still inhabit the forests of Central Hindustan. A very interesting description of a race of dwarfs which still exists in Central Africa is given in Dr. Schweinfurth's "Heart of Africa," published in 1874. The term "pygmy" is, however, now confined to a species of ape, the *Troglodytes niger* of Geoffroy St. Hilaire, a chimpanzee. Some of the classical stories appear to have suggested to Dean Swift many of the most amusing strokes in his "Voyage to Lilliput;" as, for instance, that Hercules, who had visited the land of the pygmies, when lying asleep was attacked by two whole armies, and rolled them all up in his lion's skin.

PYLO'RUS. See **STOMACH**.

PYM, JOHN, a famous English statesman and orator, was descended from a good family in Somersetshire, and was born in 1584. He entered Broadgate Hall, now Pem-

broke College, Oxford, in 1599, where he became an accomplished scholar; and on leaving the university he studied at one of the inns of court, and made himself familiar with the principles of common law. At an early age he was appointed a clerk in the exchequer office, where he acquired excellent business habits. He entered the House of Commons in 1614 as member for Colne, but it was not until 1620 that he appears to have taken an active part in public affairs. In no long time he distinguished himself in the House by his ability and zeal in resisting the arbitrary measures of James I., who, provoked at his opposition, termed Pym "a very ill-tempered spirit." He was one of the twelve commissioners (or "twal kynges," as James sarcastically termed them) who were sent to wait on his Majesty at Newmarket with a vindication of the privileges of Parliament. Becoming still more obnoxious to the court, he was summoned before the council along with the popular leaders Coke, Philips, and Mallory, and committed to the Tower for his resistance to the despotic and unconstitutional policy of the king. After the accession of Charles the activity and influence of Pym in the House of Commons became still more conspicuous. He was appointed one of the managers of the impeachment against the Duke of Buckingham in 1626, and on the meeting of the Short Parliament on the 13th of April, 1640, he delivered a powerful speech of two hours' length, and took an active part in the measures which led the king most unwisely to have recourse to a dissolution. When the celebrated Long Parliament met on the 18th of November following, Pym was at once recognized as the leader of the constitutional party; and his eloquence, knowledge, and experience in Parliamentary forms and usages gave him such vast influence that his opponents nicknamed him "King Pym." It was he who denounced Strafford as "the greatest enemy to the liberties of his country, and the greatest promoter of tyranny that any age had produced," and who impeached that statesman at the bar of the House of Lords on the charge of high treason. He supported the equitable proposal that Strafford's counsel should be heard on his behalf, but he persisted in leading the attack against that unscrupulous minister until his execution was obtained. He had promised Strafford, when the latter deserted the patriotic party, "We will never leave you till we have taken your head from your shoulders," and after the accomplishment of his promise, supplemented by the fall of Laud, he assisted in the carrying of a series of important reforms designed to compel the king to govern according to law. It was Pym who framed and proposed the Grand Remonstrance, which led to the attempted arrest of the five members, and brought about the Civil War. On the outbreak of hostilities Pym was placed at the head of the Committee of Safety, and while the other patriotic chiefs took the field, he was appointed in November, 1643, lieutenant of the ordnance, and remained in London conducting the executive, calming the fears of the people, and watching and counteracting the machinations of their adversaries. Worn out, however, with toils and anxieties, his career was rapidly drawing to a close. He died on the 1st of December, 1643, of an imposthume in the bowels, and his body was buried with great magnificence in Westminster Abbey, whence, after the Restoration, it was disinterred with others and cast into a pit in St. Margaret's Churchyard.

Pym was probably the most accomplished master of Parliamentary science that our country has ever produced. He thoroughly understood his audience, and adapted his arguments and his measures to their character and position with rare sagacity. He was a chief who possessed most of the qualities that serve and adorn the leader of a party—pre-eminent experience in public affairs, unrelaxing vigilance in the attention bestowed on them, profound mastery of those ready tactics by which occasions to weaken or

wound an adversary are fearlessly seized and unscrupulously improved. His more important speeches bear marks of careful preparation, but he was ready in debate and powerful in reply. Unlike some of his great associates, Pym was a consummate man of the world, and had nothing of the Puritan affectation of formality and sternness in his manners or dress. He was emphatically a man of authority, of weight, and was endowed to a remarkable degree with that mysterious faculty which enables its possessor to establish a complete moral ascendancy over others. He was, therefore, the master spirit of the patriotic party, and its real representative in the contest with the king, "so that while he lived there was no law in England so potent as the will of Pym."

See J. Forster's "Eminent British Statesmen" (vol. iii. London, 1837); Goldwin Smith's "Three English Statesmen" (London, 1867); and S. R. Gardiner's "Puritan Revolution" (London, 1876).

PYRAMID, in mathematics, a solid figure having its base contained by a polygonal plane, and the sides of which are plane isosceles triangles when the axis is vertical. Pyramids are triangular, quadrangular, hexagonal, &c., as the bases are triangular, square, hexagonal, &c. The pyramid occupies the same place among rectilinear solids which the cone does among curvilinear figures, and in the same way as a right cone is made upon a vertical axis, so also is a right pyramid. An inclined pyramid is that which has an inclined axis. Various derivations have been suggested for

30° N. lat., were called by the ancients the pyramids of Memphis, from their position on a rocky height projecting from the western mountains near the outskirts of the city. They stand in a diagonal line from north-east to south-west, and are of stupendous magnitude, especially the two northern. These monuments have attracted the attention of writers of every age; but minute investigations of their structure, and the purpose for which they were erected, date from the explorations of the French commission of 1798 under Bonaparte, of Colonel Howard Vyse, in 1837, and of the Prussian-English commission of 1842 under Lepsius. Mention is made of them by Herodotus, the oldest Greek historian, who was informed that they were built in a very early age as the sepulchres of the sovereigns of Egypt. According to Herodotus, the founder of the Great Pyramid (the greatest of the ancient seven wonders of the world, and the only one of them which is still in existence) was Cheops, the Egyptian *Khufu* (3124 B.C.), whose cruelty and tyranny rendered his name odious to posterity. Closing all the temples and forbidding,

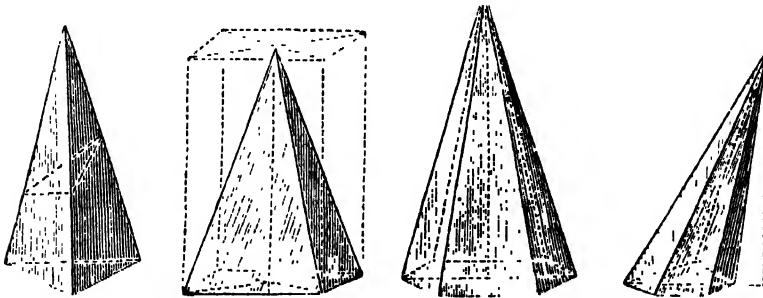
He sent the people to the Arabian hills to work in the quarries; and after excavating the stones, they were made to drag them to that part of the Libyan ridge where the monument now stands. He also informs us that the building of the pyramid occupied 100,000 men twenty years, and that on it was inscribed the sum expended on radishes, onions, and garlic for the workmen, which amounted to 1600 talents (£200,000 sterling). These statements of

the "father of history" are remarkably corroborated by the latest explorer, Mr. Flinders Petrie (1883).

The pyramid was probably built in courses or stages, each receding within the lower, and regularly diminishing to the top, thus presenting on each side a series of rude steps, every one of which is smaller than the one on which it rests; the height of the steps likewise diminishes as they ascend. The number of

these steps is at present 203. The horizontal planes of the steps are perfectly straight, the stones being cut and fitted to each other with great exactness by a cement differing from all the known ancient and modern mortars in being composed mainly, not of carbonate, but of sulphate, of lime. It is computed that about 2,300,000 stones are used in the Great Pyramid, each weighing fully 2½ tons. All this material comes from the Mokattam quarries in the hills behind Cairo or from the Arabian hills. On reaching the summit, which is not a very difficult undertaking, the view obtained of the surrounding country is very extensive, and during the inundatory period remarkably interesting and picturesque.

The following measurements are given as the dimensions of the Great Pyramid:—Area of the base, about 571,636 square feet, or 13½ acres; length of each face, when entire, 768 feet by measurement; height of each face, 610 feet; perpendicular height, when entire, 481 feet 4 inches; present area is 535,824 square feet; present face is 766 feet wide at base, 568 feet high; present perpendicular height, 451 feet 4 inches. The surface of each face of the pyramid, not including the part let into the rock, is 25,493 square yards; and its solid content is about 3,371,307 cubic yards. The pyramid stands on a limestone pavement extending from 629 to 627 inches beyond the foot of the smooth-faced casing which formerly covered the whole monument, and the whole group of three large and six small pyramids is



Triangular Pyramid. Quadrangular Pyramid. Hexagonal Pyramid. Inclined Pyramid.

the word pyramid, as, for example, *perami*, lofty (thought by some to be the same as the Hebrew *ehyaboth*), from Greek *pyros*, fire, on account of its fire-proof qualities, by others, because the pyramid is pointed at top like a flame; from the Arabic name of the pyramids, *ahrâm*, compared with the Hebrew *haram*, meaning forbidden, sacred, or consecrated; but the word will probably be found to come from Egyptian *pehram*, sacred place, or some other Egyptian source. At present its derivation must be pronounced obscure. In the form in which we have it, it comes to us from the Greek.

PYRAMIDAL SYSTEM. See MINERALOGY.

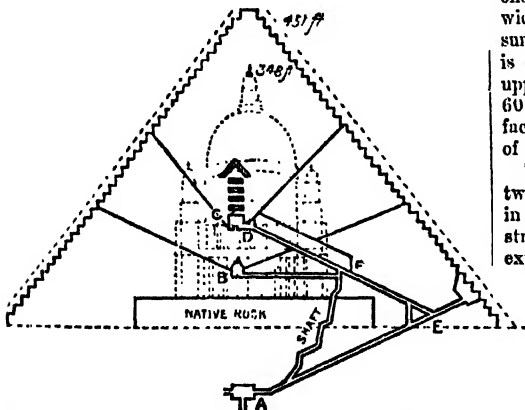
PYRAMIDS form a curious species of buildings, almost a separate department of architecture. The pyramidal structure on a square base is found among various nations both in the Old and New World, viz. the Egyptians, Greeks, Romans, and Mexicans; but by far the finest specimens are met with in Egypt. Their total number amounts to somewhere about seventy, a considerable number of which are situated along the Libyan ridge from below Cairo to the Faioum district. The following is a list of twenty-seven, which Bunsen supposes to cover the remains of as many sovereigns of Memphis:—Abou Roash, where only the base of one remains; Gizeh, 3; Zouat el Arrion, 1; Reeguh, 1; Abouseir, 3; Sakkarah, 9; Dashoor, 4; Lisht, 2; Meidoun, 1; Illahoun, 1; and the Labyrinth.

The pyramids of Gizeh, which stand between 29° and

placed upon a rock platform 150 feet above the plain. Reckoning the total height at 480 feet, the Great Pyramid is the loftiest piece of masonry in the world, except Cologne Cathedral (533 feet), and stands 16 feet higher than St. Peter's at Rome, and 103 feet higher than St. Paul's, London, with a base covering a space nearly equal to Lincoln's-Inn-Fields, about as wide as the Thames averages from Eondon to Chelsea. The whole is built on mathematical principles, and is so placed that its faces are towards the four cardinal points of the horizon. The slope of the sides is $51^{\circ} 52'$.

Originally the sides of the pyramids were incased with perfectly smooth polished casing, adorned with zones and patterns in red, black, green, and rose-coloured stone, making gigantic hieroglyphic pictures: they were seen thus as a huge bright mosaic as lately as the fourth century of our era. The apex was covered with a gilt cap rising into a sharp point. The great pyramid was called "the lights," and as the sun glittered on the golden tip and played upon the shining many-coloured surface, while the deep cloudless blue of the sky supplied a luminous background, truly it must have well merited its name.

The entrance to the Great Pyramid is situated about 21 feet to the east of the middle of the northern face, and about 49 feet above the level of the base. This passage is lined with slabs of limestone resting against each other so as to remove the superincumbent weight from it. The position of the stones in the body of the pyramid is horizontal, but at the entrance they follow the inclination of the passage, which declines in the direction of a line drawn from α Draconis, the Pole-star at the time of the building. [See POLE-STAR.] Sir John Herschel says that, "speaking in ordinary parlance, the passage may be said to have pointed at Alpha Draconis at its inferior culmination, at which moment its altitude above the horizon of Gizeh (lat. 30°) would have been $27^{\circ} 9'$, refraction being neglected as too trifling (about $2'$) to affect the question." After going along this passage for about 80 feet, down to κ in the figure, another strikes off upwards ($\nu \rho$), which leads to the grand gallery, from which a horizontal passage ($\rho \pi$) leads



to what is called the queen's chamber (n), 17 feet long, 14 wide, and 12 high. From the grand gallery, but in a different direction, another passage (n) leads to the king's chamber (c), 34 feet long, 17 wide, and $19\frac{1}{4}$ high. The roof consists of nine granite slabs, extending from side to side of the room. The walls are built of the same material. At the upper end of the room is a sarcophagus of red granite, 7 feet 4 inches long, 3 feet broad, and 3 feet 1 inch in height. It contains no hieroglyphics, but on being struck gives forth a sound like that of a deep-toned bell. Both these chambers have ventilating passages, narrow

shafts to the outside of the pyramid. Besides these rooms there are a number of chambers, some of which are very large, others of small dimensions. At the bottom of the great gallery, on the west side, is a passage, partly vertical, partly slanting and irregular, called the well or shaft, which is now closed. This well is over 200 feet in depth, of which about 145 are in the solid rock. At its lower end it enters another passage (the lower part of the first or entrance passage), 91 feet below the level of the pyramid's base, leading to the subterranean chamber λ , exactly in the middle of the pyramid's base. It is supposed the workmen, on finishing the building of the pyramid, came out by this under passage, filling up $\nu \rho$ with chips and debris, and also filling up $\kappa \lambda$ from outside after they had passed through it. These passages have now been cleared.

The second pyramid, which stands at the distance of about $2\frac{1}{2}$ furlongs south-west from the Great Pyramid, differs very little in size, though the first is far superior to the second in workmanship and construction. Its summit is still uninjured, and retains its ancient casing, formed of blocks of compact limestone from the Arabian hills, and planed smoothly down to one exquisitely smooth surface *in situ*. According to Colonel Howard Vyse, the following are its dimensions:—Former base, 707 feet 9 inches; present base, 690 feet 9 inches; former perpendicular height, 454 feet 3 inches; present perpendicular height, 447 feet 6 inches; former extent of base, 11 acres 1 rood 38 poles; present extent of base, 10 acres 3 roods 30 poles. Its foundation has been cut out of the solid rock, which is a little higher than that on which the Great Pyramid stands. The outer casing had its lowest course of granite; but all the rest of the stone work was built of materials obtained from the nummulite rocks of the neighbouring hills, or from the quarries of the Arabian mountain across the river. From so much of the casing being preserved, and on account of its being much steeper than the other, the ascent of the upper part is very difficult.

Belzoni, after great exertion, succeeded in opening this pyramid, and found its passages almost similar to those of its larger neighbour; but it contains no gallery, and its passages (which are none of them *ascending*) lead only to one main chamber—46 feet 3 inches long, 16 feet 3 inches wide, and 23 feet 6 inches high—in which is a sarcophagus sunk in the floor. No hieroglyphics were found on it. It is remarkable that this pyramid has two entrances—an upper one, which serves as the main entrance, and another 60 feet below it. These are both situated on the north face. Herodotus and Diodorus Siculus ascribe the erection of this pyramid to Kephren, brother of Cheops.

The third pyramid is nearly in a line with the other two, but of much smaller dimensions, being only 205 feet in height, and 354 feet 6 inches square at the base. In structure, it is equal, if not superior, to the other two. Its exterior was formerly cased with granite, but this has been, to a great extent, torn off. On being opened by Colonel Vyse, it was found to have been previously ransacked. Its entrance, like that of the others, is on the northern face. Inside was found a beautiful sarcophagus and a mummy case, with the name of the king *Menkaura*, the Greek *Mukerinos*, successor of Kephren, but Manetho makes it the work of Queen Nitokris. This apparent inconsistency is explained by the fact that although Menkaura built it, Nitokris, who died 2592 B.C., remodelled it, facing it with polished red syenite, about 500 years after its first erection, and used it as her own sepulchre.

Near these large pyramids are six smaller ones, three of which are on the east side of the Great Pyramid, and three on the south side of the third. These contained the tombs of near relations of the kings who founded the large ones. Two of them are for the daughters of Khufu. To the south of the pyramids of Gizeh there are a number

of small pyramids, such as those at Abouseir, Sakkarah, Dashoor, &c.

Having given some description of the pyramids, another question of importance here arises: For what purpose were they built? The opinion has long been prevalent that they were only built for the one purpose of commemorating certain kings. It is very evident, however, that if they were intended by the kings as sepulchres, the priestly architects have successfully accomplished other objects also in their construction. John Taylor, in a book entitled "The Great Pyramid, why was it built, and who built it?" (London, 1859), proposed a theory to explain its erection. He first of all demonstrated the exact geometrical proportions of the pyramid by showing that on replacing the bevelled casing stones of which the old caliphs of Egypt had despoiled it, its height was to twice the length of one side of its base, as the diameter to the circumference of a circle—an exceedingly important mathematical problem, and quite above the powers of either Egyptians or any other nation, within 2000 years of the Great Pyramid's date of building, to have solved. From the linear measure of its base he next deduced a standard measure of length more admirably and learnedly earth-commensurable than anything previously known; and he showed that its height and area of its base indicated with an accuracy only recently approached by mathematicians, the figure and outline of the earth. Inside there are proofs even more wonderful that the pyramid was built for metrological, or weights and measures purposes. In the large chamber already referred to the coffer which was found in it contains exactly four times the measure of the Hebrew ephah, as well as the ancient Saxon or present English quarter. From this circumstance Mr. Taylor gets a new derivation for this pyramid, viz., *puros*, wheat; *metron*, a measure—the name showing the purpose, as he thinks, for which it was erected. Now inasmuch as the Great Pyramid standard of length alluded to above amounts, according to the best modern measures of the earth, to exactly one ten-millionth of the earth's semi-axis of rotation—a truly grand and all-important terrestrial standard, but to which none of the ancients had any means whatever of approximating—and as it is also equal to the length which Sir Isaac Newton determined for the sacred cubit of Moses and the Hebrews, as distinguished from the profane cubits of the Egyptians, Phœnicians, and all other pagan nations, Mr. Taylor ventured to put forth the bold conclusion that the building which contained not only scientific results vastly in advance of its time, but measures of length and capacity identical with those in use afterwards among the Hebrews in the time of their chief lawgiver and inspired teacher as sacred measures, must have been built with the approval of the God of the Hebrews, or the one living and true God; and its plans and proportions must have been conveyed by inspiration to the men appointed to build it, even as the measures for the ark were conveyed to Noah. In fact he looked on the Great Pyramid as containing a "Revelation in stone from God to man," and at a period about 800 years earlier than that of Moses, but for a different purpose, viz., for the subject of weights and measures chiefly.

Later on the subject was prosecuted much more extensively by Professor C. Piazzi Smyth, astronomer-royal for Scotland; for he, after testing Mr. Taylor's theory by all published measures of the Great Pyramid, and printing his results so far, in a small book entitled "Our Inheritance in the Great Pyramid," next went out to Egypt in the winter of 1864-65, and lived for four months on the Pyramid hill, applying measurements to every available part of the Great Pyramid. The very extensive numerical documents procured in this manner were subsequently published in three elaborate volumes, under the title of "Life and Work at the Great Pyramid in 1865" (Edin-

burgh, 1867), professing to confirm authoritatively all the more important part of Mr. Taylor's theory, and extending the Great Pyramid standards from line and weight to heat, angle, and time; and with pointed reference and regulated proportions in every case to important terrestrial facts and cosmical phenomena.

But although it has been necessary on account of the frequent resuscitation of these theories and the interest they always excite, to briefly sketch the views of extreme pyramidists, it may be at once stated that they are altogether far-fetched and absurd. The unrivalled Egyptologist, Mr. W. M. Flinders Petrie, after devoting some years to preparation, went out in 1880, armed with every qualification possible, and took up his residence at Gizeh during the two succeeding winters. The result was published in "The Pyramids and Temples of Gizeh" (London, 1883), and so far as measurements and observations go has settled the bases of the problem once and for all, and for the first time the matter can be argued upon absolutely accurate fact. The first triangulation of the pyramids is due to Mr. Petrie. It is surprising to learn from his exhaustive survey that the Great Pyramid is not the miracle of construction we have always considered it to be. Mr. Petrie has been able to discover a vast amount of bad and careless workmanship, uneven surfaces, faulty perpendiculars, floors so badly paved that "no two stones are on the same level;" cracks, and settlements, and mendings, wholly unsuspected till now, and entirely at variance with all our preconceived notions of the flawless perfection of this famous structure. Mr. Petrie, remarking on the astonishing difference between the exquisite work of one part and the careless work of another, says that there was evidently a change of builders and of plan while the structure was in progress; that some parts were never finished; that others were never carried out; that good material ran short and was supplemented by inferior stone; and that from about the middle point of the work, the whole thing was hurriedly and indifferently pushed on to completion. Besides all this, he has discovered traces of serious damage, which can only have been caused by a severe shock of earthquake. The whole of the great eastern and western limestone walls of the king's chamber have "sunk bodily;" every roof-beam on the south side is cracked across or torn from its holding; and the granite ceiling, weighing some 400 tons, is upheld solely by "sticking and thrusting." As for the sacred cubit, and the pyramid inch, and the standard of measure, and the symbolism of the passages, and the divine message of the boss, granite-leaf, and coffer, and all the rest of it, it is needless to say that the whole of these theories vanish into thin air before Mr. Petrie's steel tape and chain, sound knowledge, and sound sense. Of course his discovery that each side of the base is some 50 inches shorter than was formerly believed has upset these strange theories founded on its former value, and consequently those founded on the magnitude of the height of the pyramid, and also those relating to its weight. Similar corrections explode all the other remarkable "proofs" and "revelations." But what remains is quite sufficiently absorbing in interest. For instance, exceedingly interesting is that part of the work devoted to the mechanical means employed by the builders of the pyramids. Mr. Petrie traces in the huge stones of which the pyramids are built the undoubted marks of saw-cutting and tubular drilling. He believes that the tools employed were of bronze, and asserts that this metal has left a green stain on the sides of the saw-cuts. Jewels, to form cutting-points, he believes to have been set both in the teeth of the saws and also on the circumference of the drills. (If this be true, rock-boring diamond drills are no new things.) He has even detected evidence of the employment of lathes with fixed tools and mechanical rests.

It results from these excellent observations that a theory explanatory of the building of the Great Pyramid, put forth especially by the astronomer R. A. Proctor ("The Great Pyramid," London, 1882), and indicated by other students of the subject, has increased greatly in value. According to this the ordinary exclusively sepulchral idea, which on the face of it is preposterous, must be abandoned. The immense labour and treasure are too great for king after king to spend merely on their own tomb. But on the other hand this idea, so consonant with the Egyptian extraordinary reverence for the dead, must be allowed great weight. The pyramid was built, then, to serve several great uses, which being fulfilled it was closed up and then converted into the tomb and perpetual memorial of its founder. It has been stated above that the Great Pyramid is oriented with remarkable accuracy; its sides facing duly north, east, south, and west. In the first place it was necessary to take the altitude of the Pole-star, in order to determine the elevation of the true pole of the heavens. This was an indispensable condition of the orientation of the base. Having no telescope, the architect accordingly first bored an observing tube, a *b.*, pointing northwards in the solid core of rock upon which the pyramid was to be built, and so made the base of the structure itself serve the purpose of an observatory. Having thus secured a direct view of the Pole-star, and obtained the exact points of the compass, it became necessary to devise some means of obtaining a true level. For this purpose a squared space (the subterranean chamber of the plan) was excavated at the bottom of the observing tube, and precisely in the centre of the base of the intended pyramid. This chamber, when flooded with water a few inches deep, would have afforded a water level, the only one method effective enough to give the required accuracy. (Herodotus was evidently misled by the tradition of this flooded chamber when he wrote that the underground vault was in "a sort of island surrounded by water introduced from the Nile.") Orientation and level being assured, the building would be begun: the architect meanwhile repeating these processes for each successive layer of masonry. When this masonry rose to the height of the passage-entrance on the north face of the pyramid, the builders would find themselves shut off from direct observation of the Pole-star. Their obvious course would then be to obtain a reflection of its rays, which might be done by carrying up a second passage through the masonry "in such a direction as to contain the rays from the Pole-star after reflection upon a horizontal surface, such as that of still water." This they actually did in constructing the passage commonly called the "ascending gallery;" and by plugging the lower part of the first passage, and then flooding it at its point of junction with the ascending gallery at *c.*, a mirror-like surface would be obtained upon which the rays of the Pole-star (admitted down the north aperture) would be not only reflected, but distinctly visible down the new observation-tube. The reason why the ascending passage is inclined at the same angle to the horizon as the descending passage was thus for the first time explained by Mr. Proctor. Nor is this all. Another, and a very remarkable piece of corroborative proof is yet to come. It is obvious that, at the point of junction where the second water-surface was produced, the casing stones of the descending passage would need to be most perfectly fitted and cemented, in order that the water might not percolate and drain away. Just here, accordingly, the stones are not only better joined than elsewhere, but are actually made of a harder and better material. Equally clear become, on this hypothesis, the astronomical uses of the grand gallery, which (so long as the growth of the pyramid and the building of the king's chamber did not block its outlook) was, in fact, a colossal stone transit-instrument. Nothing can be more conclusive than the architectural peculiarities of this gallery (hitherto quite

inexplicable), which are now seen to be one and all ingenious devices to narrow the walls at the top for the proper support of the superincumbent weight, while keeping them at the same time vertical for astronomical purposes. [See the representation on the same Plate with **PERSIAN ARCHITECTURE**.] Now, too, it is explained why this vast vault—being a telescope which had served its turn and could no longer be kept open—ends against a huge space of dead wall pierced only by the entrance to a comparatively small horizontal passage leading into the king's chamber. The ramp holes found in the sides of the gallery, and hitherto a great puzzle, were to hold benches, and probably also eye-pieces for the observers; and the strange groove running along each side of the gallery might be used to carry a screen. The top of the gallery would be purposely excentric, in order to allow observers to see from the corners across the centre of the platform. After the king's death his coffin would be placed on the platform, and the king's chamber built round it, with the passages too small to allow of its exit, and the rest of the pyramid would be finished.

Every pyramid was thus primarily an observatory and secondarily a tomb; but as it rose its square summit served, there seems little reason to doubt, as the carefully oriented plane for a horoscope of the king and the king's reign. The detailed proof of this astrological use of the pyramids in their unfinished state would occupy too much space here, and the reader is referred to Mr. Proctor's work. It is evident, however, that this explains why each king needed a pyramid of his own, since each man and each reign, of course, needed a separate horoscope.

A short distance south of the pyramids of Gizeh some great heaps of rubbish are now found on excavation to clearly indicate the ruins of two pyramids of nearly the same size as the Great Pyramid, which have been cast down and broken into pieces with endless labour, evidently in some great iconoclastic revolution or outburst of anger against the departed monarchs. The fancy for building pyramids is so particularly characteristic of the fourth dynasty that it is often called that of "the pyramid-builders." The pyramids of Gizeh and of Abouseir, among others, are of this age. But in truth the era of this style of architecture covers the fourth, fifth, and sixth dynasties, say from 3124 to 2592 B.C., and isolated examples occur in the third dynasty, and even earlier. The first pyramid is the "step-pyramid" of Sakkarah, and if, as is asserted by the records, this was built during the first dynasty, it must rank as the oldest building in the world, certainly before 3800 B.C., or say fifty-seven centuries ago. The pyramid of Sendfern (Faïoum) is the best preserved one of the third dynasty.

PYRAMUS and **THISBE** were two lovers, dwelling in the city of Babylon, according to the Greek tale. They were separated, but found means to converse and correspond through a friendly chink in the wall which parted them. Finally they agreed to run away together from their parents, as they forbade their union. Thisbe arrived first at the tomb of Ninos, their rendezvous, and being startled by a lioness, who was feeding on an ox she had struck down, Thisbe hastily retired to shelter. Pyramus, on his arrival directly afterwards, found his beloved's scarf, which she had dropped in her flight, and which was stained with the blood of the ox. He gave her up for lost, and killed himself, determined not to survive her. She, recovering from her alarm, returned, and finding Pyramus expiring from his wound, shared his fate. Shakespeare, in his "Midsummer Night's Dream," introduces this ancient tragic tale, but in a somewhat ludicrous fashion.

PYRENEES, *Pyrenæi Montes* of Julius Cæsar, and the *Parinè* of Strabo, a range of mountains extending from the Mediterranean Sea to the Bay of Biscay, and constituting a natural barrier between France and Spain. The

etymology of the name is uncertain. Next to the Alps the Pyrenees are in general the highest mountains in Europe. The primary formation is less extensive than in the former range; it consists of granite, micaceous schist, and primitive limestone, which forms a continuous band stretching three-fourths across the peninsula. The bulk of the Pyrenean system is composed of secondary rocks, which are arranged in vertical bands, flanking the older strata, and consist of clay slate, grauwacke, and blue limestone. The oolite and chalk formations occur on the lower part of the chain. The Pyrenees are connected on the north-east with the CÉVENNES; and on the west their prolongation forms the mountains of Guipuzcoa, Biscay, Asturias, and Galicia, which terminates in Capes Ortegal and Finisterre, and the other headlands of the north-west of Spain. The present article is a notice of that part only of the system to which the name Pyrenees is usually applied.

The area occupied by these mountains is about 13,000 square miles. The length of the chain from Cape Creux, near the town of Rosas, in Cataluña, to the Port of Passages in Guipuzcoa, is about 270 miles in a straight line. The breadth varies from 20 to 60 miles; it is greater near the central part of the chain than towards the extremities. The Pyrenees pass along the border of the following departments of France, enumerated in order from east to west:—Pyrénées-Orientales, Ariège, Haute-Garonne, Hautes-Pyrénées, and Basses-Pyrénées. In Spain the Pyrenees pass through Cataluña, the valleys of Andorre and Arran, Aragon, and Navarre. On the north side the mountains send off numerous offsets, which cover part of the French departments.

The range of the Pyrenees may be regarded as consisting of two parts, both having the same general direction, but not forming one continuous line: the point of dislocation is near the source of the Garonne, where the main ridge recedes southwards, so as to inclose the head of the Val d'Arran, and then, having advanced a little way along the western side of the valley to the northward, it again resumes its original direction of east and west. From the Garonne to the Mediterranean the principal ridge is more advanced towards the north than between the source of the Garonne and the Bay of Biscay. The southern slope is much steeper, and the ascent invariably more difficult than the northern. It is worthy of remark that the loftiest summits are not found in the direction of the main ridge, but at short distances from it, in some of the numerous short spurs thrown out on both sides.

At their eastern extremity, in Cape Cerbère, the Pyrenees are about 1470 feet high above the sea; they rise rapidly as they proceed westwards, reaching 1920 feet near Bellegarde; after a slight depression here, which forms the Pass of Pertus, they swell to the lofty mass of Costabona, whence springs to northward the spur crowned by the Canigou, 9135 feet high. The principal ridge attains the height of several thousand feet not far from Mont Louis, and, instead of the rounded summit terminating in plateaus covered with forests or pastures, it begins to assume bolder and more imposing forms; a crest bristling with peaked summits and scarped rocks, frowning chasms, and precipices, become the leading features. Sinking to 5113 feet to form the Pass of La Perche, it soon rises to 6394 feet, and increases to 7673 feet near the valley of Vic-Dessos; here it again swells to above 9000 feet, and sends out northwards the spur that contains Montcalm, whose summit is 10,513 feet high. From this part to the source of the Garonne in the Val d'Arran the height is almost uniformly about 7673 feet. After bending round the Val d'Arran another massive swell takes place in the main ridge, whence projects to the southward the gigantic spur containing the Maladetta, which reaches the height of 10,863 feet, and is one of several peaks that are gathered nearly in a semicircle round the Peak of Néthou, or Malalite, the loftiest summit

in the Pyrenees, which has an elevation of 11,168 feet above the sea. Between the Maladetta and the Val d'Ossau the principal chain reaches its greatest height, the crest maintaining an elevation of 8320 feet, while the spurs thrown out north and south contain several very lofty peaks, among which are—the Punta-de-Lardana, 11,000 feet; the Tours-de-Marboré, the highest of which has an elevation of 10,660 feet; Mont Perdu, 10,991 feet; the Vignemale, 10,817 feet; the Pic-du-Midi, 9436 feet. In this part also are numerous lakes, glaciers, cascades, and, inclosed between the lateral ranges, transverse valleys of great length abounding in magnificent scenery. [See PYRÉNÉES, HAUTES.] West of the Val d'Ossau the summit of the main ridge, as well as of the branches, again assumes the generally rounded form, and in many places is covered with pastures; here and there, however, are still seen peaks extending 7500 feet in height. The range at its western, as at its eastern extremity, is crossed by several practicable passes, called *ports* or *cols*, the most important of which are noticed in the account of the French departments named above. Altogether there are more than fifty passes for mule and foot passengers, though only five are good carriage roads, and but two of these are open at all seasons of the year, being at a less elevation than 5000 feet. In 1862 a line of railway was constructed over the Pyrenees, from the port of BILBAO to Tudela, which has since been connected with the northern railway of Spain, thus enabling the journey between Bilbao, on the Bay of Biscay, and Madrid, to be performed in about fourteen hours. This was the first line of the kind opened in Europe, the contract being undertaken by an English firm; the iron for the railway, the engines, and the vehicles being all made in Great Britain. The communication is now (1886) to be still further improved, for the French and Spanish governments have agreed to the construction of two lines of railway, one to pierce the mountains at the Port de Canfranc, the other at Solanet, to the south of Ariège. The Pyrenees, as considered in this article, terminate near Fontarabín, in the masses which inclose the valley of the Bidassou, while the main ridge continues its western course under various names across the north of Spain.

The lateral branches of the Pyrenees, as of all great mountain masses, are thrown off at the points where the main ridge rises into lofty summits; while the heads of the valleys are marked by depressions, which constitute the natural passes from one side of the mountains to the other. All the great valleys of the Pyrenees are transverse. The vale-head is usually at a port, and the valley extends for many miles towards the north or south, bounded by the lateral branches of the mountains. Many of the vale-heads are of a nearly circular form; the one most famous for its romantic scenery is the Cirque of Gavarrie, in Hautes-Pyrénées. [See PYRÉNÉES, HAUTES.] Many of the valleys present a succession of basins, locally called *oules*, or pots, through which the stream that waters the valley winds slowly, assuming a character in keeping with the quiet scenery of these secluded spots. In the upper part of the valleys, where these basins are more frequent and more perfect in their form, they often contain lakes. Lakes are numerous on the French side of the mountains, some of them in very elevated sites; on the Spanish side there are very few.

Snow lies deep in the mountains during a great part of the year, and is perennial on the higher points. From the Mauboré to Maladetta the summits are covered with broad bands of ice, yet no true glaciers have been found. Avalanches occur in the higher situations, as in the Alps. The line of perpetual congelation on the Pyrenees appears to vary, rising considerably higher on the northern than on the southern slope, but it may be stated to be about 9000 feet above the sea. The climate is also variable, being warmer at the extremities, because of the inferior height of

the mountains and the proximity of the sea. Here the winters are short, and in the lower valleys snow rarely lies more than a day or two. In the upper valleys the climate is more rigorous. The pine and the fir, the box, the rhododendron, the Alpine rose, and a variety of other trees and shrubs grow on the sides. The summers in all the valleys are very warm, and vegetation is luxuriant, corn and maize being cultivated. Thunderstorms are frequent.

Numerous streams rise both on the northern and the southern side of the Pyrenees. Those on the southern side, except a few near the eastern extremity, flow into the Ebro. The waters of the northern slope are carried into the Bay of Biscay by the Adour, the Garonne, the Ariège, and their numerous feeders; towards the eastern extremity the Aude, the Tech, the Tet, and the Gly, are tributaries of the Mediterranean. There are numerous mineral springs in the neighbourhood of the Pyrenees. Those of Bagnères-de-Bigorre, Bagnères-de-Luchon, Barrèges, St. Sauveur, in the valley of Lavedan; Cantèze; Eaux-Bonnes, in the Val d'Ossau; Eaux-Chaudes, in an adjacent valley; Ax, in the valley of the Ariège; Alet, in that of the Aude; and some others—are of considerable note.

The recesses of the Pyrenees are the haunts of the ibex, a variety of the chamois, of smaller size and brighter colour. The bear, lynx, and the wolf are also found. The former is generally met with in the high desert regions near the snow line, and the lynx ascends to above 8000 feet. The slopes of the mountains afford pasturage in summer to numerous flocks, which are driven thither from the plains or lower slopes where they pass the winter. Medicinal plants abound. The Pyrenees contain iron ores, and copper and argentiferous lead mines were formerly worked, but are now abandoned. Several of the streams are auriferous, but no gold or silver is obtained. The valley of Cardona contains a remarkable deposit of rock-salt, one of the beds measuring 390 by 750 feet. Fine statuary and other marble, including some of the most beautiful varieties, is quarried. Among the mountaineers the goitre is a common disease.

PYRÉNÉES, BASSES, a department in France, formed out of the principality of Béarn, is bounded N. by the departments of Landes and Gers, E. by that of Hautes-Pyrénées, S. by the Pyrenees and Spain, and W. by the Bay of Biscay. Its greatest length from east to west is 88 miles; the breadth varies from 55 to 13 miles. The area is 2943 square miles; and the population in 1881 was 431,366.

Hydrography.—The department lies on the slopes and at the foot of the Western Pyrenees, which send out numerous offshoots to the north-west, dividing the surface into a great number of valleys, each watered by a clear rapid stream that ultimately falls into the Adour on the northern boundary. From the Basque word for running water these mountain rivers are called *gaves*. The principal of them are the Gave-de-Pau, which drains the north-east, and the Gave-d'Oloron (formed by the gaves that drain the valleys of Aspe and Ossau), which runs through the central districts. More to westward are the Bidouze and the Nive (this enters the Adour at Bayonne), the Nivelle, which rises in Spain and enters the Gulf of Gasconne at St. Jean-de-Luz, and the Bidassoa, which marks the boundary between France and Spain for a short distance before its entrance into the Bay of Biscay below Fontarabie. Timber and other articles are floated down all these rivers almost from their sources. Such of them as fall directly into the sea have a tide navigation a few miles from their mouths.

Surface and Soil.—The lower valleys of the department, the principal of which are those of Baigorry, Soule, Aspe, and Ossau, are fertile. The vale-heads in many instances have the form of an amphitheatre (locally called *oule*, from the Spanish *olla*, pot), enclosed by high mountains, and connected with the valleys by narrow gorges;

some of them also present beautiful cascades. The high valleys and lower slopes of the Pyrenees afford excellent pasture, on which great numbers of cattle, swine, sheep, mules, and light Navarrese horses are fed. The hillsides are in general covered with vineyards, which yield very good wine, and with plantations of fruit and chestnut trees. The best kinds of wine are those of Jurançon and Gan. The high mountains are to a great extent covered with forests of pine, fir, and oak, which afford good ship timber. Along the Adour there is some marsh land, and in the north-west and near the sea there are naked barren wastes. The principal crops are wheat, rye, barley, oats, millet, chestnuts, and maize, which last forms the chief food of the peasantry. The growing of flax and hemp, the trade in hams with Pau and Bayonne, and the traffic in mules and cattle with Spain, are the most important sources of wealth to the agriculturist. Silver, copper, iron, lead, coal, salt, cobalt, and sulphur are found. Slate, marble of all colours, granite, alabaster, rottenstone, and marl are quarried. Of the numerous mineral springs the most famous are those of Eaux-Bonnes and Eaux-Chaudes, in the upper part of the Val d'Ossau. Salt from the springs of Salines is held in much repute. Game abounds in the highlands, and includes roebucks, bears, wolves, ibexes, chamois, otters, &c.

Climate.—The height of the Pyrenees, which is not so great as in the neighbouring department, whence the name, and the snow that lies on them several months in the year, the proximity of the ocean, and the great number of springs, streams, marshes, and rivers, which, presenting a considerable surface, absorb a large quantity of heat, modify the temperature of the department very considerably, and render it much less genial and colder than one would expect from the latitude. From the end of February to the end of April the south wind blows regularly, changing winter into spring; west winds succeed for the next two months; and during the summer and autumn the north and north-west winds prevail. In some districts men and women, the latter especially, are very subject to goitre, the diseased gland sometimes exceeding the size of the head.

Manufactures and Products.—The manufactures include linen, calico, coloured handkerchiefs, flannel, druggist, capes, hosiery, Bearnese caps, carpets, chocolate, liqueur, brandy, paper, leather, pottery, and some iron. Ships are built on the Adour and on the coast. The articles of commerce are the various products already named, and wine, liquorice, rosin, prepared skins, wool, hides, deal planks, oaks, gall-nuts, liat, colonial produce, salt, &c. Considerable quantities of Châlosse and Armagnac brandy are distilled and exported. Two roads lead across the Pyrenees to Spain; and the department is also crossed by the railway from Bordeaux to Hendaye, on the Spanish frontier, with a branch from Bayonne to Orlhac and Pau.

The department was comprised in the Roman *Novempopulana*. It is inhabited chiefly by two distinct races, the Bearnese and the Basques, who differ from each other in character and language. There are also several of that once degraded race, the *Cagots*, who are believed to be descended from the *Saracens*.

The department is divided into the five *arrondissements* of Pau, Oloron, Orthez, Bayonne, and Mauléon. The town of PAU is the capital.

PYRÉNÉES, HAUTES, a frontier department of France, formed out of the districts of Bigorre and Quatre-Vallées, and a portion of Nébouzan, is bounded N.E. by the department of Gers, N.W. by Landes, E. by Haute-Garonne, S. by Spain, and W. by Basses-Pyrénées. Its greatest length is about 70 miles, and its greatest breadth 45. The area is 1748 square miles, and the population in 1881 was 286,474.

General Aspect and Character.—The department takes its name from the Pyrenees, which attain their greatest

height on the southern boundary, where *Monte-Maladetta*, *Mont-Perdu*, and the highest peak of the *Vignemale* group reach respectively 10,863, 10,991, and 10,817 feet above the sea-level. Stretching northwards from this great mountain barrier, the district presents a surface diversified by plains, hills, forests, valleys, gorges, high mountains, torrents, and waterfalls. Two lateral offsets of the Pyrenees extend northwards and terminate in the two ranges of hills that inclose between them the fine plain of *Bigorre*. Between this plain and the main range of the mountains occur a great number of picturesque valleys, where the scenery comprises within little compass the quiet well-sheltered village, the snow-clad mountain, with rocky precipitous sides, or with slopes shaded by dark forests, the whole echoing with the noise of waterfalls or the furiously-running *gave*. Among the most noted of these valleys is that of *Cauteretz*, celebrated for its hot springs. The road or path to the *Cirque de Gavarnie* from the village of *Gèdres* runs through some savage mountain scenery, and among a chaos of massive blocks of stone, many of them large enough to afford singly sufficient material for building a cathedral. On reaching the vale-head there is seen a vast semicircle of precipitous rocks, about 1640 feet high, broken into three stages or steps, on one of which a glacier rests, forming part of the ice-field of the *Mont-Perdu* group. From a lake among the glaciers on this lofty mountain, the *Gave-de-Gavarnie*, the head water of the *Gave-de-Pau* leaps down the side of the cirque 328 feet at a single bound, and striking against one of the steps or ledges above-mentioned is dashed into spray, which, struck by the rays of the sun, forms an infinite number of rainbows, some of a completely circular form. The broken waters from this point form seven cascades (these again divide into a greater number on striking the next ledge), and at length uniting at the bottom, after a total fall of above 1600 feet, rush through a hollow vault worn out under the rock-strewn floor of the *Cirque de Gavarnie*. Excursions are made over rocks, snow, and glaciers, from *Gavarnie* to the *Tour-du-Marboré*, and to the pass called *Brèche-de-Roland*, a colossal gap in the mountain wall 330 feet wide, and nearly 9000 feet above the sea, which *Roland*, of the famous sword, is fabled to have made for his followers, but which is now frequented only by smugglers and adventurous tourists. There are, however, many passes more practicable than the *Brèche-de-Roland*, at a height of 6000 to 7000 feet, but they are all subject to tremendous hurricanes; and such is the danger in threading them, that it is a received axiom among these stormy heights "that the son must not wait for the father, nor the father for the son."

The *Pic-du-Midi-de-Bigorre*, which stands in front of the main mass of the Pyrenees, at the south of the plain of *Bigorre*, rises to the height of 9436 feet above the sea-level. It is ascended by the valley of *Barèges* and the gorge of *Grip*, but not without difficulty. In clear weather the view from its summit is truly magnificent; to the southward the Pyrenean range extends in a vast crescent-like mass, surmounted at different distances by tremendous peaked or rounded heights, whose slopes are covered with snow-heaps or with ice-fields that contrast strongly with the sombre hue of the dark brown rocks near them. To the northward all inequalities of surface seem annihilated, and a vast plain spreads itself out before the eye, comprising the departments of *Basses-Pyrénées*, *Gers*, and *Haute-Garonne*.

The hilly region which extends over a great portion of the department north of the *Pic-du-Midi-de-Bigorre*, is furrowed by numerous streams flowing through lateral valleys of great beauty, and emptying themselves into the *Adour* or the *Garonne*. The fine plain of *Bigorre*, in the centre of which stands the town of *Tarbes*, inclines gradually towards the north. The ranges that inclose it

on the east and west are covered with woods throughout their whole length; the *Adour* and its feeders drain it; good high roads, diverging from *Tarbes*, and several other branch roads, traverse its surface, which is strewed with towns, villages, and hamlets in all directions.

Hydrography.—The principal rivers are the *Adour*, which runs throughout the department from south to north; the *Garonne* and its feeder the *Neste*, which drain the south-eastern districts; the *Gave-de-Pau*, which flows through the beautiful valleys of *Cauteretz* and *Argèdes* in the south-west on its way to join the *Adour*; the *Genès* and the *Baise*, feeders of the *Garonne*, and the *Larros*, a tributary of the *Adour*, which drain the north-east of the department. The *Alaric Canal* serves for the irrigation of the plain on the right bank of the *Adour*; it is about 30 miles in length, and turns above sixty mills. It commences below *Bagnères*, passes a little east of *Tarbes*, through *Rabastens*, and enters the *Adour* below *Maubourguet*. This canal was opened in the year 507.

Climate.—The climate is in general good and healthy; the temperature in the plains of *Bigorre* is mild, but, as may be expected from the nature of the surface of the department, any temperature almost may be obtained by varying the elevation. All the atmospheric phenomena succeed each other in the high lands with remarkable rapidity and inconstancy. The prevailing wind blows from the south-west, and it is attended very frequently with violent rains. The spring is mild, but sometimes late frosts are destructive to the young vegetation; summer is dry and windy; the autumn is invariably fine and clear; the winter foggy.

Products, &c.—Notwithstanding the fertility of the soil in the valleys, the grain produced is insufficient for the consumption. The principal crops are buckwheat, maize, potatoes, figs, mulberries, &c. A plentiful supply of white and red wine of good quality is made. The breed of horses is excellent; horned cattle and sheep are very numerous; good butter and cheese are made; mules and asses are reared, likewise pigs and large numbers of poultry, especially geese, the legs of which are salted for export. Bees are carefully tended, and honey and wax are abundant. Bears and wolves are of great size and ferocity, and the sheep are protected from the latter by the powerful dogs of the Pyrenees.

Iron, copper, zinc, lead, manganese, nickel, and cobalt are found, but no mines are worked; marble of different colours, building stone, slate, granite, amianth, kaolin, marl, fuller's earth, and potter's clay are raised. Mineral and hot springs abound. Those of *Cauteretz*, *Bagnères*, and *Barèges* are much frequented. The principal manufacture is of woollen stuffs, called *Barèges*.

The commerce is chiefly in cattle, corn, mules, and horses for Spain, timber, oak staves, hoops, agricultural products, linen, cotton, and woollen stuffs, cutlery, nails, and hides.

The department is divided into the three arrondissements of *Tarbes*, *Argèdes*, and *Bagnères*. The chief town is *TARBES*.

PYRÉNÉES-ORIENTALES, a department in France formed out of *Roussillon* and a portion of *Languedoc*, and named from its position at the eastern extremity of the Pyrenees. From E. to W. its greatest length is 75 miles; from N. to S. 35. The area is 1592 square miles, and the population in 1881 was 208,855.

General Character and Hydrography.—The department is bounded S. by the main ridge of the Pyrenees, except at one or two points where it encroaches on their southern slopes; W. by the *Val d'Andorre* and *Arriège*, from which last it is separated by an offshoot of the Pyrenees on the left bank of the *Aude*; N.W. and N. by the department of *Aude*, from which the *Corbières Mountains* on the right bank of the *Aude* divide it; and E. by

the Mediterranean. A plain of considerable width, and in general of great fertility, extends along the sea-shore, which, reckoning all its indentations, measures about 45 miles. On the coast are the marshes of Lencate and St. Nizier, and the rest of the coast is a series of small bays.

FROM SOUTH TO EAST, WITH

that of the Tet; the other range runs from west to east between the Tet and the Gly, into which last the Verdonble runs from the south-eastern slopes of the Corbières. All these mountains are furrowed by numerous valleys and by streams that enter the principal rivers already named, which fall into the Mediterranean. A small portion in the west of the department is drained by the Aude, which flows out of Pyrénées-Orientales by the defile between the Roc-Blanc and the Corbières Mountains. On the southern slope of the Pyrenees, and not far from the sources of the Tech and the Aude, the Segre, a Spanish river, takes its rise. Not one of these rivers is navigable, but the waters of most of them are turned to good account for fertilizing the land by means of an excellent and extensive system of irrigation, whereby, in the plain of Perpignan, the valleys of the Tet, the Tech, and the Gly, not less than 70,000 acres of land are rendered exceedingly productive. Two canals, those of Millas and Perpignan, date respectively from the years 1163 and 1172: the latter is nearly 20 miles long, with a mean breadth of 10 feet and a total fall of 300 feet.

Soil and Products.—The soil in the plains of the arrondissement of Perpignan consists of a layer of vegetable earth about a foot deep, resting on sand or gravel. By careful husbandry and by an extensive system of irrigation, it is made to produce fine crops of wheat, rye, black and white oats, maize, millet, barley, broad and haricot beans, flax, hemp, fruits, &c. The olive and the vine are extensively grown, and in the valleys the climate is mild enough to admit of the culture of the pomegranate and the mulberry. The orange thrives on espaliers. The arrondissement of Ceret, drained by the Tech, is with little exception a cold mountainous country, cut up by narrow arid valleys; placed above the region of the vine, it produces only rye, oats, maize, chestnuts, and pulse. The arrondissement of Prades, also very mountainous, is diversified by several ranges of vine-clad hills, and by valleys inferior neither in soil nor cultivation to the plain of Perpignan, which it also resembles in its products. The red wines of Roussillon are in general of excellent quality, agreeable taste, strong body, and well adapted for transport; they are used for giving colour and body to the lighter growths of Cahors and Auvergne. The wines of Collioure and Port-Vendres have the highest repute; they fine themselves and become of a golden hue with age; in this state they take the name of *Rancio de Roussillon*. The sweet wines of Rivesaltes hold the first rank among the dessert wines of France.

The mountains of the department are in many parts clothed with fine forests of oak, beech, pine, and fir, and abound with aromatic and medicinal plants. The cork tree grows naturally, and is also an object of careful cultivation. There is but little grass land, but the breadth of heath, moor, and mountain pasture is very considerable. Good farm and saddle horses, a great number of mules for the Spanish markets, few horned cattle, but a large number of sheep, and common and Tibet goats, are bred. Bees and silkworms are carefully tended; poultry, game, and fish are abundant. Among wild animals are the wolf, bear, fox, wild boar, chamois, eagle, vulture, and serpents.

Industrial Resources.—A great number of iron mines are worked, and the ore is smelted and converted into malleable iron at many forges and furnaces, by means of charcoal prepared on the spot. Copper, lead, bismuth,

antimony, and alum are found. A coal mine is worked near Estavar; fine marble, alabaster, granite, and steatite, are quarried. There are a great number of hot and mineral springs, the most frequented of which are those of Amélie-les-Bains, formerly called Arles-les-Bains.

The manufactures are not important, though the industrial products include (besides wine and iron) coarse woollen cloths, leather, corks, knit stockings and caps, brandy, whip-handles, common pottery, tiles, and bricks. The fisheries on the coast are actively plied, and large quantities of sardines and anchovies are preserved. The coasting trade in the leading articles named, and in wool, oil, honey, &c., is active.

Climate, &c.—The climate is good: the heats of summer in the plains are moderated by sea breezes; in winter the cold is not intense; snow rests only on the mountains of the Canigon and about Mont Louis; if it falls elsewhere, it disappears in three days at most. The south west wind, called *la marinada*, which brings moisture, and the *tramontane*, or N.N.W., which is dry, are the prevailing winds.

The language of the inhabitants is a mixture of the Langue d'Oc, the Catalanian, and the Castilian.

The department is divided into the three arrondissements of Perpignan, Ceret, and Prades. The chief town is PERPIGNAN.

PYRE'NOMYCE'TES, a suborder of fungi belonging to the group ASCOMYCETES. The asci are long and club-shaped, and each produces eight spores; they are formed in small round or flask-shaped receptacles, called perithecia. The perithecium is either open from the first, or a narrow orifice is ultimately formed through which the spores escape. The spores on germination reproduce the mycelium, on the filaments of which are formed other kinds of spores. In some cases, as in the fungus which is so destructive to rye, the Ergot (*Claviceps purpurea*), the perithecia do not arise directly on the mycelium, but are formed on the surface of dense club-shaped masses of the filaments called *stromata*. The pyrenomyces are parasitic on living plants, as the ERGOT on the rye, or on dead organic matter, or in some cases on living insects. They are found in all parts of the world, and a considerable number of species are British.

PYRE'THRUM is a genus of plants belonging to the order COMPOSITÆ, nearly allied to CHRYSANTHEMUM. *Pyrethrum Pasticum* (the feverfew) is common in waste places in many parts of Britain, but it is doubtful whether it is truly indigenous. It has bitter tonic properties, and is a popular remedy in slight fevers, whence its English name. It is said that the odour is peculiarly disagreeable to bees, and that these insects may be easily kept at a distance by carrying a handful of the flower-heads. The feverfew has an erect branching stem, from 1 to 2 feet high, pinnate leaves, and flower-heads in small terminal corymbs. The florets of the disc are yellow, those of the ray white. Other species of this genus occur in the temperate parts of the Old World, and many are in cultivation as garden plants. The brilliant green of the leaves is effective as an edging to borders. The Pellitory of Spain of commerce is the root of *Anacyclus Pyrethrum*, a nearly allied species, now separated from this genus. See PELLITORY.

PYR'IDINE, a base obtained by Anderson from bone oil; it is also found in the tars of coal, shale, and peat. It is a colourless liquid, with powerful odour and bitter taste. The specific gravity is 0.9858; it boils at 117° C. (242° Fahr.) It is very soluble in water. The formula is C_5H_5N . It precipitates salts of iron, zinc, and copper, the latter dissolving in excess with a brilliant blue colour. It forms with acids definite salts, crystalline and soluble in water. Pyridine hydrochlorate has the formula C_5H_5NHCl . It forms double salts with gold and platinum: pyridine chloro-aurate, $C_5H_5NHClAuCl_3$, and pyridine chloro-platinate, $2(C_5H_5NHCl)PtCl_4$.

PYRITES (Gr. *pur*, fire) is the general term applied to a group of natural metallic sulphides, and alludes to the fact that the harder varieties produce sparks when subjected to friction. When broken they emit a sulphurous smell. The principal species are IRON PYRITES, Copper Pyrites (or CHALCOPYRITE), Arsenical Pyrites (or MISPICKEL), and Cobalt Glance. The first is largely worked for the manufacture of sulphuric acid, copperas (sulphate of iron), and alum, the sulphur entering into its composition being much more readily available than the iron. The other pyrites are mined for the extraction of their respective metallic bases. See COPPER, ARSENIC, COBALT.

PYROACE' TIC SPIRIT. See ACETONE.

PYROGAL' LIC or DIOXYPHENIC ACID. This acid is obtained by the sublimation of gallic acid. Carbonic acid is given off, and pyrogallie acid sublimes in large colourless prisms. It is very soluble in water. The formula is $C_6H_4O_3$. It melts at $115^\circ C.$ (239° Fahr.); at $250^\circ C.$ (482° Fahr.) it gives off water, and becomes metagallic acid ($C_6H_3O_2$)



It forms a number of salts called pyrogallates, which are not very stable, and little known. In the presence of alkalis pyrogallie acid in solution oxidizes very rapidly and becomes black, forming carbonate and acetate of the alkali used. It is constantly employed in the laboratory for the estimation of oxygen in gaseous mixtures. It is also much used in photography as a developer; also in some mixtures sold for dyeing the hair. It gives a beautiful red tint with milk of lime, which is characteristic, and forms a delicate test for the acid.

PYROLU'SITE (Gr. *pur*, fire; *luo*, to wash) is the naturally occurring dioxide of manganese, and forms the most important ore of that metal. When heated to redness it evolves about 10 per cent. of oxygen, and is thus extensively employed for the oxidation and removal of the impurities producing the brown and green tints of glass; from this cleansing property the mineral received its scientific name. Pyrolusite is also used for the preparation of chlorine in the manufacture of bleaching powder, and for the production of oxygen. The sulphate and chloride made from it are employed in calico printing. The mineral is of a bluish-black colour, with a metallic lustre, and it is distributed in minute quantities in rocks almost as widely as the oxides of iron. In many sandstones and flaggy limestones it occurs in beautiful moss-like (or dendritic) infiltrations upon the surfaces of the various beds, and these markings are often mistaken by the inexperienced for remains of fossil plants. An impure hydrated oxide of manganese, termed *wad*, is ground and manufactured into the important pigment, UMBER.

PYROMANCY (Gr. *pyromanteia*), a classical method of divination by means of the sacrificial fire. If, when the victim was placed on the altar, the flames immediately seized and consumed it, or sent up its sparks in a pyramidal form, or shot up in bright and steady spires, good fortune was prognosticated, but the contrary was an omen of evil.

PYROMETER, a term which literally means fire-measurer (Gr. *pur* and *metron*), was first employed by Muschenbroek to designate an instrument invented by him for measuring the effects produced in the dimensions of solid bodies by the application of heat; but its significance has since been extended so as to include those instruments the object of which is to measure all gradations of temperature above those which can be indicated by the mercurial thermometer. See HEAT.

Muschenbroek's *Pyrometer* (1780) consisted of a metallic bar, about 6 inches in length, one extremity of which was fixed, while the other was left free to advance as the metal elongated from the effect of several spirit-

lamps placed beneath, which at each experiment were charged with the same quantity of highly-rectified spirit of wine. The advance of the movable extremity gave motion to a pinion and wheel, the latter of which drove an index over a graduated circle, each degree of which corresponded to a linear expansion of the $12,500$ th of an inch. The instrument was improved by Desaguliers, who substituted fine cords and friction-rollers for the wheel and pinion.

Borda's Pyrometer.—The rods employed by Borda in measuring the base-line of the great French survey consisted of a rule of brass laid upon a somewhat longer rule of platinum and attached at one extremity. The portion of the platinum rule not covered by the one of brass was divided into millionths of its entire length, and further subdivided by means of a vernier and microscope adjusted to the extremity of the brass rule. The value of each of these divisions having been previously ascertained, by first surrounding the compound rule with melting ice, and then immersing it in boiling water, it was only necessary to observe the indications of the vernier in order to apply the requisite correction for reducing the length of the rod to the standard temperature.

Ramsden's Pyrometer.—For low temperatures the contrivance of Ramsden (1785), employed by General Roy in determining the expansion of the rods used in measuring the base on Hounslow Heath for the Trigonometrical Survey, was perhaps unexceptionable. The rod was immersed in a trough of water, and over each extremity was placed a microscope, to which a slow motion could be given in the direction of the length of the rod by means of a fine micrometer screw. The lines of collimation of the microscopes being thereby adjusted at the commencement of the experiment, so as to accurately coincide with two points near the extremities of the rod, the temperature of the water was gradually raised, till a thermometer placed in the trough indicated an advance of 10° , 20° , 30° , or any required number of degrees. The consequent elongation of the rod destroyed the coincidence of its extremities with the lines of collimation of the microscopes, which was re-established by turning the micrometer screws, and carefully noting the number of turns and fraction of a turn necessary for that purpose.

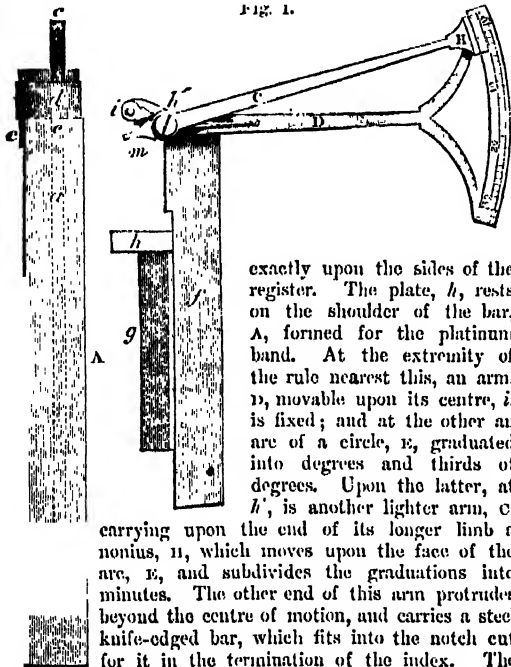
Wedgwood's Pyrometer.—The property of alumina, whereby it undergoes a diminution of bulk when heated, was employed by Wedgwood in 1782, as a measure of high temperatures. His pyrometer consisted of cylinders of fine white clay, and an apparatus for accurately measuring their length. This apparatus consisted of a metallic plate, upon which were fixed two brass rules slightly inclined to each other. The rules used by Wedgwood were 24 inches long, and divided into 240 equal parts. The distance between the rules at one extremity was three-tenths, and at the other five-tenths of an inch; consequently the difference between their distances at any two consecutive divisions was the 1200 th part of an inch. The clay cylinders were first baked at a red heat (about 947° Fahr.), and then reduced to exactly five-tenths of an inch in length, so as to fit the first division of the scale. When afterwards exposed to a greater heat they underwent contraction, and the amount of this contraction was determined by observing the division of the scale corresponding to their diminished length. This was the pyrometer generally used till quite recently.

Daniell's Pyrometer.—Professor Daniell, of King's College, London, invented a pyrometer in 1821, for which the Rumford medal was awarded to him later on by the Royal Society. Daniell's "register pyrometer," represented in fig. 1, was formerly much used. It consists of two parts, namely, the register and the scale. The register is a solid bar of black lead, A, highly baked, in the axis of which is drilled a hole, reaching to within half an

inch of the end; into this hole a bar of iron or of platinum, *aa*, is introduced. A cylindrical piece of porcelain, *c*, sufficiently long to project a short distance from the extremity, is placed endwise upon the iron, and the former is bound to the bar by a band of platinum, *d*, passing round both, and tightened, if necessary, by a wedge of porcelain, *e*. When this instrument is exposed to a very high heat, the whole increases in bulk in proportion to its intensity; but the rate of expansion of the metal and of its casing being unequal, the porcelain cylinder, *c c*, will be protruded to the extent of the difference.

To measure the length of the protruded portion the scale is applied. This consists of two brass rules, *f g*, joined together by screws, to form a right angle, and fitting

FIG. 1.



exactly upon the sides of the register. The plate, *h*, rests on the shoulder of the bar, *A*, formed for the platinum band. At the extremity of the rule nearest this, an arm, *n*, movable upon its centre, *i*, is fixed; and at the other an arc of a circle, *z*, graduated into degrees and thirds of degrees. Upon the latter, at *h'*, is another lighter arm, *c*, carrying upon the end of its longer limb a nonius, *n*, which moves upon the face of the arc, *z*, and subdivides the graduations into minutes. The other end of this arm protrudes beyond the centre of motion, and carries a steel knife-edged bar, which fits into the notch cut for it in the termination of the index. The index bar is pressed firmly down upon the metal encased in the black lead by the wedge and band of platinum; the bar is then nicely adjusted in the angle formed by the two rules of the scale, the plate, *h*, firmly held against the shoulder, and the knife edge, *m*, resting in the notch in the index bar; the position of the latter is now noted on the scale, and after the register has been heated and allowed to cool the scale is again applied and the result observed; the difference is the value of the expansion of the metal bar. By comparing this with the indications given by a mercurial thermometer between any two points, say that of the freezing and boiling of water, an expansion in degrees of Fahrenheit's scale may be given to any degree of artificial heat measurable by the instrument.

Prinsep's Pyrometer.—Mr. Prinsep, the assay-master of the mint at Benares, based a pyrometer on the fusing-points of pure metals, which are determinate and unchangeable;

they also comprehend nearly the whole range of temperature. The unoxidizable or "noble" metals alone embrace a range from the low melting-point of silver to the high ignition of platina. There are, it is true, only three fixed points in this scale, but as many intermediate links may be made as are required, by alloying the three metals together in different proportions. When such a series has been once prepared the heat of any furnace may be expressed by the alloy of least fusibility which it is capable of melting. As the melting-points of silver and gold are comparatively near to each other, Mr. Prinsep assumed only ten intermediate gradations of heat, the lowest of which corresponded to the fusing-point of pure silver, and the others to the fusing-points of silver alloyed with 10, 20, 30, &c., per cent. of gold. From the melting-point of gold to that of platina he assumed 100 gradations of heat, which were the melting points of pure gold and of gold alloyed with 1, 2, 3, &c., per cent. of platina. Among the advantages of this mode of identifying temperatures are—the smallness of the requisite apparatus, nothing more being needed than a small cupel, containing in separate cells eight or ten pyrometric alloys, each of the size of a pin's head; the indestructibility of the specimens, since those melted in one experiment need only to be flattened under a hammer, when they will be again ready for use; and the facility of notation, since two letters and the decimal of alloy will express the maximum heat: thus "S 3 G" expresses the temperature of the fusing-point of silver alloyed with gold in the proportion of 7 to 3; and "G 23 P" expresses that of gold alloyed with platina in the proportion of 77 to 23.

Berquerel's Pyrometer (1860).—This is a thermoelectric couple formed by the union of a wire of platinum with another of palladium, the current generated regularly increasing with the temperature up to the fusing-point of the latter at about 2730° Fahr. For an account of his researches see the *Comptes Rendus* for December, 1862, and November, 1863.

Ericsson's Pyrometer.—In the first international exhibition, of 1851, Mr. Ericsson exhibited in the United States department a pyrometer, in which temperatures were indicated by the tension of a permanent volume of air or of nitrogen gas, which was measured by the reading of a column of mercury under a vacuum.

Siemens' Pyrometer.—The pyrometer most generally used (Wedgwood's) was never regarded as altogether satisfactory; and in 1870 Mr. C. W. Siemens, F.R.S., invented what is called the electrical resistance pyrometer, which is based on a certain peculiarity in the pure metals—that their resistance to the electric current increases with the temperature. A fine platinum wire of 0.01 inch diameter, the resistance of which averages 3.6 units per yard of length, is coiled upon a cylinder of hard baked pipe-clay,

Fig. 2.

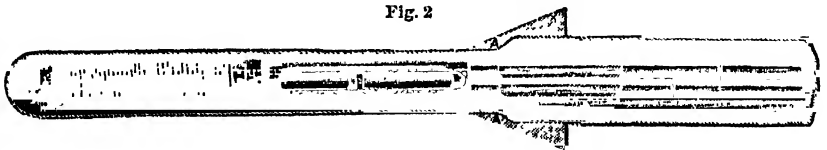
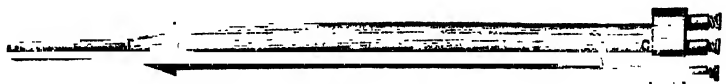


Fig. 3.



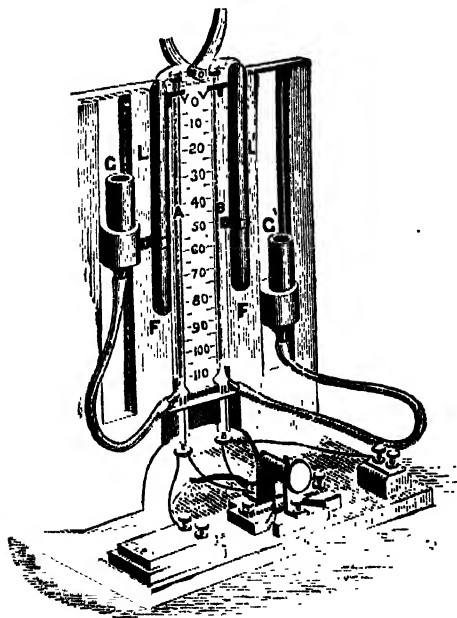
in which a double threaded helical groove is formed (to prevent the convolutions from coming into contact with each other). The form of pipe-clay cylinder is shown in fig. 2. At each end of the spiral portion, *u v*, it is provided with a ring-formed projecting rim, *c* and *c'*, the purpose of

which is to keep the cylinder in place when it is inserted in the outer metal case, and to prevent the possibility of contact between the case and the platinum wire. Through the lower ring, c' , are two small holes, $b b'$, and through the upper portion two others, $a a'$. The purpose of the upper holes, $a a'$, is for passing the ends of the platinum wires through before connecting them with the leading wires. From these two holes, downwards, platinum wires are coiled in parallel convolutions round the cylinder to the bottom, where they are passed separately through the holes, $b b'$. Here they are twisted, and by preference fused together by means of an oxy hydrogen blowpipe. At this end, also, the effective length and resistance of the platinum wire can be adjusted, which is accomplished by forming a return loop of the wire, and providing a connecting screw-link of platinum, r , by which any portion of the loop can be cut off from the electric circuit.

The pipe-clay cylinder is inserted in the lower portion, $A A$, of the protecting case, shown in fig. 3. This part of the case is made of iron or platinum, and is fitted into the long tube, $c c$, which is of wrought iron, and which serves as a handle. At the points, $A A$, fig. 3, the thick platinum wires are joined to copper connections, over which pieces of ordinary clay tobacco-pipe tube are drawn, and which terminate in binding screws fitted to a block of pipe-clay, closing the end, c , of the tube. A third binding screw is provided, which is likewise connected with one of the two copper connecting wires, and which serves to eliminate disturbing resistances in the leading wires. If temperatures not exceeding a bright red heat are to be measured the platinum-protecting tube may be dispensed with, and iron or copper substituted.

The next part of the apparatus is the *differential voltmeter*. This consists of two similar narrow glass tubes, A

Fig. 4.

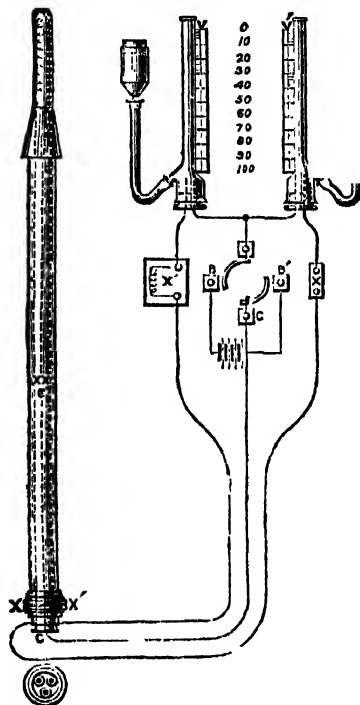


and B , of about 2.5 millimetres in diameter, fixed vertically to a wooden frame, F , with a scale behind them divided into millimetres or other divisions. The lower ends of these tubes are enlarged to about 6 millimetres in diameter, and each of them is fitted with a wooden stopper saturated with paraffin and pierced by two platinum wires, the tapered ends of which reach about 25 millimetres

above the level of the stopper. These form voltametric electrodes. From the enlarged portions of each of the two voltmeter tubes a branch tube emanates, connected by means of an india-rubber tube, the one to the movable glass reservoir, α , and the other to α' (fig. 4). These reservoirs are supported in sliding frames by means of friction springs, and may be raised and lowered at pleasure. The upper extremities of the voltmeter tubes are cut smooth and left open, but weighted levers, L and L' , are provided with india-rubber pads, which usually press down upon the open ends, closing them, but admitting of their being raised, with a view of allowing the interior of the tubes to be in open communication with the atmosphere. Having filled the adjustable reservoirs with dilute sulphuric acid, on opening the ends of the voltmeter tubes, the liquid in each tube will rise to a level with that of its respective reservoir, and the latter is moved to its highest position before allowing the ends of the tubes to be closed by the weighted and padded levers.

Fig. 5 represents the connections of the voltmeter with the pyrometer, and also shows the necessity for the

Fig. 5.



third leading wire. One electrode of each voltmeter is connected with a common binding screw, which latter may be united at will to either pole of the battery, whilst the remaining two electrodes are, at the same moment, connected with the other pole of the same battery; the one through the constant resistance coil, X , and the other through the unknown resistance, X' . This unknown resistance, X' , is represented to be a pyrometer coil.

By turning the commutator seen in front of fig. 4, either in a right or left hand direction, from its central or neutral position (in which position the contact springs on either side rest on ebonite), the current from the battery flows through the two circuits, causing decomposition in the voltmeters; and the gases generated upon the electrodes accumulate in the upper portions of the graduated tubes. By turning the commutator half round every few seconds the current

from the battery is reversed, which prevents polarization of the electrodes. When through the position of the commutator the current flows from the copper, it passes first through the connected electrodes to the voltmeters, where it divides, one portion passing through the constant resistance, λ (fig. 5), through the leading wire, x , to the pyrometer, returning by the leading wire, c , to the battery, the other passing through x' , through the leading wire, x' , through the platinum coil, returning by the leading wire, c , to the battery. When the current flows from the zinc it passes first through the leading wire, c , the current dividing at the pyrometer, one portion returning by the leading wire, x , through the constant resistance, λ , through one voltmeter tube to the battery, and the other through the platinum coil, x' , through the leading wire, x' , to the voltmeter tube, and thence to the battery. The value of the third leading wire, c , in eliminating the disturbing effect which long and short leading wires with varying temperature would certainly have upon the correct indications of the instrument, is at once evident.

The action of this instrument depends upon the combination of FARADAY'S law of decomposition—

$$t$$

(i being the intensity of the current, v the volume of liquid decomposed, and t the time of action of the current), with OHM'S—

$$i = \frac{E}{R}$$

(where E represents the electro-motive force, and R the resistance of the electric circuit).

The relative volumes, v and v' , of the gases accumulated in an arbitrary space of time within each tube must be inversely proportional to the resistances, R and R' , of the branch circuits, because

$$v : v' = \frac{E}{R} t : \frac{E}{R'} t,$$

and therefore,

The resistances, R and R' , are composed, the one of the resistance c , plus the resistance of the voltmeter λ , and the other of the unknown resistance x' , plus the resistance of the voltmeter λ . But the instrument has been so adjusted that the resistances of the two voltmeters are alike, being made as small as possible, or equal to about one mercury unit, to which has to be added the resistances of the leading wires, which are also made equal to each other, and to about half a unit; these resistances may therefore, both of them, be expressed by γ .

We have, then—

$$v : v' = c + \gamma : x' + \gamma,$$

or,

$$x' = \frac{v}{v'} (c + \gamma) - \gamma,$$

which is a convenient formula for calculating the unknown resistance from the known quantities c and γ and the observed proportion of v and v' . In order to work this instrument between wide ranges of temperature it is necessary to make c variable and nearly equal to x' .

PYROPE (Gr. *purōpos*, fire-like) or Fire-Garnet is a dark-red variety of garnet, composed of the double silicate of alumina and magnesia. It is generally transparent, but rarely occurs in good crystals, and is referred to by the ancients under the name of *Anthrax*.

PYROPEORUS, a term applied to any substance which takes fire spontaneously on exposure to the air. Many such substances are known in chemistry, but the

oldest is that called Homberg's Pyrophorus, which is prepared by heating alum in a closed crucible to redness with lampblack, starch, or sugar. The active agent here is potassium sulphide, which is thus obtained in a state of minute division, combined with finely divided carbon. The same effect is observed with iron, zinc, lead, nickel, cobalt, and manganese, all of which, in a finely divided state, are pyrophoric, and ignite in the air. Zinc-ethyl, cacodyle, phosphorus, phosphorated hydrogen, and many other such bodies, present this great attraction for oxygen, which raises the heat to the point of ignition and renders them spontaneously inflammable.

PYROSIS. See WATERBRASH.

PYROSOMA is a remarkable genus of the group TUNICATA. It is a free-swimming colonial organism having the form of a hollow cylinder open at one end, and composed of numerous individuals or zooids placed side by side in the common semi-cartilaginous mass. The mouths of the zooids open on the external surface of the colony, while their exhalant orifices open into the common cloaca in the interior. The zooids resemble in structure the solitary Salpæ. The water taken in at the wide mouth-opening serves the purposes both of nutrition and respiration; it passes through the wide latticed branchial chamber into the atrium of the zooid, and then falling into the canal common to all the zooids, produces a current which drives the colony on through the water. As in most tunicates, there is an asexual method of reproduction by means of budding. But each individual, in addition to producing buds which develop into new zooids, can also reproduce itself by means of eggs. The egg does not, however, give rise immediately to an individual like its parent, but to a barrel-shaped zooid, which then by budding produces a group of four *Pyrosoma* zooids.

The *Pyrosoma*-colony is from 2 to 14 inches long, and from $\frac{1}{2}$ inch to 3 inches in circumference. They are frequently met with floating on the surface in mid-ocean, and attract attention by the brilliant phosphorescent light which they emit. This phosphorescence is produced by two patches of fatty cells at either end of the body of each zooid. The light is intermittent, and commences suddenly at one part of the colony, and gradually spreads till the whole glows with a soft bluish light. One species, *Pyrosoma atlanticum*, is common in the Atlantic, and two other species are found in the Mediterranean.

PYROTECHNY or **PYROTECHNICS** (Gr. *pur*, fire, and *technê*, art), in a military sense, the science of applying gunpowder and fire in manufacturing the implements of modern warfare; but in the commonly-received acceptance the term is applied to the art of making fireworks, which are not only used as signals of joy or distress, but as displays for the amusement of the public on festive occasions. The art was practised among the Chinese from the earliest times, and until within a recent period they surpassed all other countries in their beautiful displays of pyrotechny. Before the invention of gunpowder fireworks were hardly known in Europe, and that is now the principal ingredient used in their composition. The other materials are sulphur, charcoal, saltpetre, steel filings, and several salts and oxides. Various proportions of these are mixed and put into papercases of the form and size required; both ends are then sealed up till use, when one extremity is ignited, and according to the shape of the piece the effect will be streams of fire issuing straight out of the cases, varied with sparks in the form of stars and brilliantly coloured, or wheels of sparks produced by making the cases revolve rapidly. The single fireworks most commonly in use are called squibs, serpents, crackers, rockets, Catherine wheels, Roman candles, Bengal lights, Chinese fire, &c. For large displays "set pieces" to represent outline portraits, pictures, waterfalls, &c., are constructed, which, under favouring circumstances, have a

very brilliant effect. Many ingenious devices are used by pyrotechnists in order to produce various colours in the display of fireworks. Thus the addition of strontian produces a brilliant crimson; zinc and antimony, a bluish white; salts and oxides of copper, blue and green; iron filings and borings give fine stars; camphor and benzoïn yield odorous fumes and white fire; and hard wood saw-dust produces the golden rain.

PYROXANTHIN or **EBLANRIN**, a substance found in wood spirit. It crystallizes in yellow needles, insoluble in water; soluble in alcohol, ether, and acetic acid. It melts at 144° C. (291° Fahr.) and sublimes at 134° C. (273° Fahr.) It dissolves with a deep red colour in sulphuric acid. The formula is $C_6H_4O_2$.

PYR'OXENE is a general mineralogical term denoting **AUGITE** and its closely allied species.

PYROXYLIC SPIRIT or **WOOD NAPHTHA**. See METHYL ALCOHOL.

PYROXYLIN. See GUN COTTON.

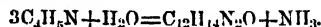
PYR'RHIC DANCE, a kind of warlike saltatory movement called by the Romans *Pyrrhica saltatio*, which Pyrrhus is said to have introduced at the funeral games of his father Achilles. The motions were quick and nimble, like those of a soldier defending himself in battle.

PYR'RHIO (Gr. *Pyrrhōn*), a Greek philosopher and founder of the Pyrrhonian or first Sceptic School, was the son of Pleistarchos, a native of Elis, a town of Peloponnēsos. He lived about the time of Philip and Alexander of Macedonia, and was originally a poor painter, but after having learned the elements of science he followed Alexander the Great in his Eastern expedition, and thus became acquainted with the doctrines of the Indian gymnosophists and the Persian magi. During the greater part of his life he lived in quiet retirement, abstaining from pronouncing decided opinions upon any subject, and endeavouring to preserve the greatest calmness and composure under all circumstances. Pausanias saw his statue in a portico at Ellis, where he was chief priest, and a monument erected in honour of him at a little distance from the town. The Athenians honoured him with the franchise of their city. He died at the advanced age of ninety.

An undisturbed peace of mind appeared to him the highest object of philosophy. He considered a real knowledge of things to be impossible, and virtue to be the only thing worth striving after; for, as he very truly pointed out, Plato's theory of ideals had been overthrown by Aristotle's theory of demonstration; but the latter rested on the observation of phenomena. Now what is to assure us that we have rightly apprehended the phenomena? The modern conception, that we should investigate the *how* and let the *why* alone was, of course, not existent, nor even possible to the Greek mind. On all occasions he answered his opponents, "What you say may be true, but I cannot decide." He had many distinguished followers and disciples, who are called Pyrrhonists, or simply Sceptics. Their doctrines are best explained by Sextus Empiricus: their object was rather to show the weakness of all other systems than to establish a new one. The philosophy of Pyrrho and his followers is called Pyrrhonism, a name which, in subsequent times, has been applied to any kind of scepticism.

PYR'RHOL. This body is always present in the products of destructive distillation of nitrogenous substances. It is characterized by causing firewood moistened with hydrochloric acid to assume a red colour. It is a fragrant colourless liquid, with pungent taste. It boils at 183° C. (271° Fahr.), and is soluble in alcohol and ether, but very slightly so in water. The specific gravity is 1.077, and the formula C_4H_6N . When heated with hydrochloric acid a red colouring matter, known as pyrrhol red, is deposited. It is insoluble in water and ether, in acids and alkalis, but is slightly soluble in hot alcohol. The formula is

$C_{12}H_{14}N_2O$. It is derived from pyrrhol by the substitution of water for ammonia.



PYR'RHUS or **PYRRHOS** (Gr. *Pyrrhos*), King of Epeiros, was born about 318 B.C. He was brought up by Glaukias, king of the Illyrians, for his father Aiakidēs had been dethroned, and a few friends had fled with the child from Epeiros. At the age of twelve he was taken back to Epeiros, and received as king. But Kassandros, the Macedonian regent, induced the people to drive him away again. Accordingly Pyrrhos joined Dēmētrios, who had married his sister, and took part in the battle of Ipsus. He afterwards went to Egypt in favour of Dēmētrios, where he gained the esteem of Berenikē, wife of Ptolemy, who gave him her daughter in marriage, and got a fleet and money for him from her husband. Returning to Epeiros he consented to share the sovereignty with Neoptōlēmos, whom the Epeirots had raised to the throne in his absence. But the two did not agree, and Pyrrhos put to death his rival—a man of cruel disposition, who had attempted his colleague's life—295 B.C. His former friend Dēmētrios,



Coin of Pyrrhus in the British Museum—actual size (silver).
The head is probably that of Jupiter.

by a murder, had become king of Macedonia; and it was evident that the two neighbours were jealous of each other's growing power. War soon broke out between them (B.C. 291), and terminated in the overthrow of Dēmētrios. Pyrrhos, however, could not hold the country long, and had to retire in 286. In 281, having been requested by the Tarentines to help them against the Romans, Pyrrhos consented. He took with him a considerable army, besides a number of elephants—viz. 20,000 foot, 3000 horse, 2000 archers, 500 slingers, and 50 elephants. Most of the troops were lost in a storm before he arrived at the place of his destination. Here he found it necessary to assume the part of a dictator, and prepared vigorously for war. At the river Siris, after a severe engagement with the Romans, victory proved on the side of Pyrrhos. After this battle he advanced towards Rome, and sent Cineas with proposals of peace, which the Romans declined. Accordingly he approached nearer the city, ravaging the territories through which he passed, and took Prenestē. Hearing that the enemy had concluded peace with the Etruscans he withdrew into Campania, and thence to Tarentum. In 279 B.C. he began his new campaign, and met the Roman army near Asculum in Apulia, where he gained another victory, but one bought with the loss of the flower of his army. Soon after the Greeks in Sicily invited him to their aid against the Carthaginians. Having obtained a truce from the Romans he crossed over to Sicily, where he drove the Carthaginians before him, and took the strong city of Eryx. He was repulsed at Lilybaeum, where they had fortified themselves. The Sicilian Greeks now became discontented with him; plots were formed, and insurrections broke out. Hence he gladly accepted the invitation of his Italian allies to come and help them against the Romans. With great difficulty he reached Tarentum again, and soon after was

defeated in a battle near Beneventum by the Roman consul Curius. Having applied in vain for troops and money to the kings of Macedonia and Syria, he finally took his departure from Italy, leaving Milo at Tarentum. He had been absent from Epeiros six years. Of all his great army he only took back 8000 foot and 500 horse. He now was desperate for money, and for this reason attacked Macedonia, which he quickly reduced. In 273 he was invited to Argos by Aristean, the head of one faction there, as Aristippos was of the other. By night Aristean admitted him within Argos, on which the Argives sent to Antigonus, son of Démétrios, and the dispossessed king of Macedonia, and Araios also arrived with a body of Spartans. At day-break Pyrrhos, seeing the danger of his situation, wished to get out of the city, but in making the attempt, assisted by one of his sons, he was killed by an old Argive woman, who hurled down upon him a huge tile from her house roof. Thus died Pyrrhos, 272 B.C. He was the greatest general of antiquity next to Hannibal. As a man and king he contrasts favourably with most ancient monarchs. Ambitious he was, and fond of glory, unsatisfied and restless, but his temper and disposition were generous.

PYRUS is a genus of plants of the order ROSACEÆ and group POMEÆ. There are between thirty-five and forty species, natives chiefly of Europe and Central Asia. They are trees or shrubs, with entire or pinnately-divided leaves and showy flowers. The calyx-tube adheres to the ovary, and the remains of its five teeth frequently persist on the top of the fruit, as in the apple; the petals are five, the stamens indefinite, and the carpels five or fewer. The fruit is a pome, the calyx-tube being greatly enlarged and fleshy, and inclosing the ovaries, which are leathery or cartilaginous, and contain each one or two seeds. The most important species economically are the APPLE (*Pyrus Malus*) and the PEAR (*Pyrus communis*), both extensively cultivated for the sake of their fruits. Other well-known species are the SERVICE TREES (*Pyrus Sorbus* and *Pyrus torminalis*), the Mountain Ash (*Pyrus Aucuparia*, see ASH, MOUNTAIN), and the BEAM-TREE (*Pyrus Aria*), most of which furnish useful timber. The Dwarf-crabs are small bushes, natives of North America, with the exception of *Pyrus Chamaemespilus*, which occurs in the mountains of Central Europe. The QUINCE (*Cydonia vulgaris*) and the MEDLAR (*Mespilus germanica*) are considered by Bentham and Hooker as subgenera of *Pyrus*.

PYTHAGORAS (Gr. *Pythagoras*) was born in the island of Samos about 570 B.C., according to Aristoxenos and Iamblichos, or 609 B.C., according to Eratosthenes. His life, as it has been transmitted to us, is for the most part fabulous. It was first drawn up in the early centuries of the Christian era by the Alexandrian philosophers Porphyry and Iamblichos. His parentage was attributed sometimes to Hermès, in proof of which he is said to have exhibited a golden thigh. The authentic particulars of his life are but scanty. During his early manhood he lived under the dominion of Polukratès, the ruler of the island of Samos. Ovid informs us that the tyranny of Polukratès drove Pythagoras from Samos; but it is uncertain whether personal ill-usage, or a mere dislike to arbitrary government, was the cause of his self-imposed banishment. He travelled for some time in the Peloponnèses; and it was here, in conversation with Leôn the ruler of Philos, that he invented and applied to himself the term "philosopher." Hitherto the Greek sages had been styled "wise men;" now, and henceforward, they adopted the humbler title of "lovers of wisdom." (Cicero, "Tusc. Disp." v. 3.) It is probable that Pythagoras continued his travels into Egypt, and that he derived from the Egyptian priests his conception of the society which he afterwards organized, and which is known as the Pythagorean bond or league. This society was moral and educational, and to some extent political. It bore the impress of a priestly or monkish

VOL. XI.

order. Uniformity and strictness were its groundwork. Before admittance to the order the members had to go through a probation of five years, during which time they had to keep silence, or at least indulge in no idle or unprofitable talk. Their clothing, their food, their occupation, their rising up and their lying down, all were determined by rule. Ascetic practices were indulged in. Animal food was forbidden, and beans were, for some reason unknown, held in abhorrence. Each hour had its allotted work. Homer and Hesiod were learned by heart. Music and gymnastics were continually practised. It was thought that constant occupation of any kind was a better check on our evil inclinations than any mere struggling against them. These truths seem now-a-days sufficiently trite; but in those early times it was a great matter to bring men to a common understanding, and to the acknowledgment and observance of certain universal rules. This was an essential step in their civilization. Pythagoras settled down at Crotona, in the Bay of Tarentum, one of those Greek colonial settlements in Southern Italy which at this time far surpassed any city in the mother country in literature, opulence, and refinement. Here, in the reign of the last of the Roman kings, he expounded his philosophy and established the society of which mention has been made. It exercised, as was to be expected, great influence on the morals and manners of the inhabitants of Crotona; but it also excited much jealousy and opposition. Its aristocratical and somewhat exclusive character was inconsistent with the citizen-life of the Greeks. People dislike those who either are or pretend to be better than their neighbours; and hence the Pythagorean league became unpopular, particularly with the democratical party at Crotona. Commotions arose. Pythagoras was either killed in one of these insurrections, or, by another account, he starved himself to death at Metapontum, 504 B.C.

The Pythagorean philosophy has come down to us under two manifestations, an earlier and a later. Under both forms its data are very meagre and obscure. Pythagoras left no writings behind him, and in the hands of his later admirers his doctrines degenerated into a mystical symbolism which is utterly incomprehensible. The earlier form of the philosophy, in so far as it is extant, is preserved in the fragments of Philolaos, a contemporary of Sokrates, and in a few short notices by Aristotle. For the later form Sextus Empiricus, who lived in the first half of the third century after Christ, may be referred to. Aristotle lays down the general principle of the Pythagoreans in the following terms:—"Number, according to them, is the essence of all things; and the organization of the universe, in its various determinations, is a harmonious system of numbers and their relations." Pythagoras attributed to number a real existence. He considered the principles of number in the form of contrasting pairs, as straight and curved, limited and unlimited, one and many, odd and even, and the like. These first principles, again, were traced to the unit (Gr. *monas*), the formal as well as material basis of all things, and as identical with the one supreme being, or God. The perfect development of the original unit is represented in the actual world, which consists of small and large wholes of every variety. The special principle of every whole or organization is again a unit, or a point separating itself from the rest; and as it is a living germ it develops itself into a distinct body of peculiar form and proportions. Every abstract idea was thus in reality a number, and physical objects were symbolical representations of numbers. Pythagoras was one of the great founders of mathematics, and also, in the Greek sense, of music. One entire system of ancient music is based upon the harmony of numbers discovered by Pythagoras.

Many fantastic notions about the heavens and heavenly bodies are attributed to Pythagoras. The souls of men he considered as light particles of the universal soul diffused

through the whole world. (Cic. "De Nat. Deor." i. 11.) The soul of man was divided into three parts—*Gr. nous, phrón, and thymos*: the two former were considered as the rational half of the soul, and had their seat in the brain; the last, or *thymos*, was the animal half, and its seat was in the heart.

The doctrine of the transmigration of souls may have been derived by Pythagoras from the Egyptian priests. He and his followers considered it a kind of purifying process. The souls, previous to their entering into human bodies, floated in the air, whence they were inhaled by the process of breathing at the moment of birth. At death they descended into the lower world, after which they again rose into the upper and floated in the air, until they entered into new bodies. When by this process their purification had become complete, they were raised to higher regions, where they continued to exist and to enjoy the presence and company of the gods. In this state they could hear the harmony of the spheres, each orb giving out the note suitable to its distance from the sun and its velocity, the sun occupying the centre of the universe, according to Pythagoras. As Shakspeare puts it—

"There's not the smallest orb which thou behold'st
But in his motion like an angel sings:
Still quiring to the young-eyed cherubims:
Such harmony is in immortal souls;
But whilst this muddy vesture of decay
Doth grossly close us in we cannot hear it."

—"Merchant of Venice," v. i.

The Pythagoreans, according to Aristotle, were the first who determined anything in moral philosophy. Their ethics are of the loftiest and most spiritual description. Virtue was with them a harmony, unity, and an endeavour to resemble the Deity. The whole life of man should be an attempt to represent on earth the beauty and harmony displayed in the order of the universe. The mind should have the body and the passions under control: the gods should be worshipped by simple purifications, offerings, and by sincerity and purity of heart.

(For a careful examination of the principles of the Pythagorean brotherhoods and their astronomical system, see Grote and Thirlwall's histories of Greece; Ritter's "History of Philosophy;" Sir G. Cornwall Lewis' "Astronomy of the Ancients," and Lewes' "Biographical History of Philosophy.")

PYTHEAS (*Gr. Pytheas*). There were two Greeks of the era of Alexander bearing this name. The first was a political opponent of Demosthenes at Athens, often shifting sides, venal and worthless, though clever; the second was a much greater man. He was one of the Greek colony of Massilia (Marseilles) in Gaul, and was a considerable traveller by sea, visiting Britain and "Ultima Thule" (probably the Shetlands), and, in fact, coasting all Europe from Gadir (Cadiz) to the Tanais (the Vistula), thence along Norway to the Arctic Circle. His works are lost, but quotations keep alive their memory. It is known that he described Thule as six days' sail from Britain, and as having six months' day and night alternately. From this latter remark some have thought he may have reached Iceland, but that seems improbable on the face of it. Stephen of Byzantium is the last person known to have possessed the works of Pytheas, and he lived from about 475 to 525, a century and a half after the geographer. It is deeply to be regretted that he did not better preserve the treasure committed to his charge. The voyages of Pytheas arose out of commercial competition. The Greeks of Massilia burned to rival the Carthaginians on the sea, and especially to compete with them for the produce of the Tin Islands of the West (Scilly and Cornwall). They, therefore, engaged Pytheas, who was celebrated as a mathematician, already renowned for his measurement of the declination of the ecliptic and for his calculation of the latitude of Marseilles by comparing the height of a gnomon with the

solstitial shadow. He was right within forty seconds, as we now know, a very remarkable piece of accurate work. Pytheas also pointed out that the POLE-STAR is not truly at the pole, the latter being in a blank space in the heavens.

What makes the loss of these important books so regrettable is that we should have in them a record of our own islands three centuries further back than the Commentaries of Caesar. Enough is said of the worship of earth-goddesses, of colonies of island women adoring a barbarous god with bloody rites, and refusing to admit a man among them, &c., to rouse our curiosity. Pytheas remained long in Britain, as he found it the most interesting place in his travels, and he coasted the whole eastern side and sufficiently beyond to determine that it was of a three-cornered shape. He came to Kent along the Channel, and stayed there from spring till autumn. He praises the fruitful wheat-fields, and notices the practice of threshing in bays, "because they have so little sunshine that our open threshing-floors would be of little use in that land of clouds and rain." He added that "they made a drink by mixing wheat and honey"—which is evidently metheglin or honey-beer, thus being the first to mention the national English drink. He condemned it, however, in his own person, as "producing pain in the head and injury to the nerves." Of course he was a wine-drinker. The people, he says, had "mean habitations of rushes and sticks, and their harvest consists in cutting off the ears of corn and storing them in pits underground; they take out each day the corn which has been the longest stored and dress the ears for food." All the fragments preserved, both relative to Britain and to Germany, show the great accuracy of this ancient traveller, and the number of them shows the high estimation in which he was held by the ancients. The loss of his books is for us one of the most serious losses of antiquity.

PYTHIAN GAMES (*Pythia*), one of the four great national festivals of the Greeks, were celebrated near Delphi (the ancient *Pythón*) in honour of Apollo, originally every eighth year, and afterwards every fourth year (in the autumn of the third year of each Olympiad). Corsini and others, followed by Boeckh, place them in the spring, in the month Mounachion, the tenth of the year. It is stated by Pausanias and Strabo that the contest was originally in music; the songs were in honour of Apollo, celebrating his victory over the Python; and the instrument used was the lyre. The prize in the Pythian games was originally of silver or gold; but afterwards a crown of laurel, or as Ovid says, of a species of oak, was substituted.

PYTHIAS, or more correctly **PHINTIAS**. See DAMON.

PYTHON (*Gr. python*), one of the famous monsters of the Greek mythology, sprang from the mud and slime which covered the earth when the waters of the deluge abated. It had a serpent like form. Apollo slew it in the defiles of Parnassus, and founded the Pythian games to commemorate the achievement. There is no doubt whatever that this myth embodies the bright rays of the sun piercing like arrows the long killing night of winter, and freeing the earth from its bondage.

PYTHON is a genus of constricting serpents belonging to the family Boidæ. The pythons of the Old World are distinguished from the boas [see BOA] of America by the presence of intermaxillary teeth and by having the plates under the tail in two rows instead of one; otherwise in structure, appearance, and habits they nearly resemble them. They are found in the warmer parts of the Old World, in Africa, Asia, and the Malay Archipelago, and a closely allied genus occurs in Australia. They are very large snakes, and seen sometimes to attain a length of 25 or even 30 feet, but usually they are between 10 and 20 feet long, and about the thickness of a man's thigh in the largest part. They feed on small mammals and birds, which they seize with their teeth and kill by crushing them in the folds

of their body. Their jaws are very dilatable, and so they are able to swallow whole animals larger than the circumference of their body. The passage of the prey down their throat is assisted by a copious secretion of saliva, but there seems no foundation for the statement often made that they lick their prey all over before swallowing it. Their prehensile tail assists them greatly in climbing, and they also swim well.

The Rock Snake or Adjigur (*Python molurus*) is a native of India, Java, &c. It is usually from 7 to 13 feet long, but sometimes attains a considerably greater size. The head is distinct from the body, broad, elongated, and depressed on the summit, and terminates in a narrow rounded muzzle. The eye is of moderate size, nearly lateral and directed slightly forward. The body is covered with numerous smooth scales. The ground colour of the skin is a pale yellowish-brown with gray marblings. Like the African python, this species incubates its eggs. It feeds on deer, &c., and is said to attack pigs. The Ular-sawa of the Malays (*Python reticulatus*) is a very similar snake, common in the Malay Archipelago, and usually about 16 feet long. The African Python (*Python Siba*) or Guinea Rock Snake, is found on the west coast of Africa, and attains a large size. The natives of some parts of the country are said to hold it in great reverence and to protect it from molestation. The Diamond Snake (Morelia), which inhabits Australia, is closely allied to the pythons.

PYX is the Greek *pyxis* (*pusis*, boxwood), that is, a small box, usually of boxwood, and especially a casket or jewel box to hold ornaments and precious things. These jewel boxes of the Greek and Roman ladies were often enriched with inlaid work and with carving, and were also of other materials than boxwood. Hence a pyx came to mean a box to hold anything precious, and thus in medieval times to mean the vessel in which the most precious of all things was hidden away, namely, the host or consecrated wafers of the mass. The pyx was often of gold, and blazed with precious stones. It was often the most valuable thing among the church vessels, and ran risks such as may be judged by the famous entry of 1531 in the annals of St. Margaret's Church at Westminster, charging the churchwardens expenses "for mette (meat) for the theffe (thief) that stolle the pyx."

From its original use as a treasure casket the word served to designate the chest at the mint wherein the coins were deposited for testing. This, which was called "the trial of the pyx," was performed at irregular intervals; but since 1870 it has been performed annually. The contractors in former days, when coinage was contracted for, were only paid by sums on account until the pyx had been tried. A few coins from every day's mintage are thrown into the gold pyx or the silver pyx, according to their metal, and it is assumed that they are a fair average of the day's work. Trial plates are preserved with great

care, under locks commanded by various officials, and these are made rigorously exact as to fineness, alloy, &c. They serve as the standard whereby to try the pyx. Trial plates covering four centuries are preserved at the mint. They are under the control of the warden of the standards.

The pyx or box used by the mint is a plain iron safe divided into three compartments, two for silver coinage and one for gold. It is secured by three intricate locks, each opened by different keys, which are intrusted to distinct officials at the heads of the chief branches of the mint. In the upper lid are carefully protected apertures, which allow the money to be put in, but by no means permit of its extraction. The formal proceedings of the trial of the pyx are as follows:—A jury of goldsmiths, who assemble at Goldsmiths' Hall, are appointed and charged with the assay of the pyx. Into their custody are given all the officers of the mint, until, by finding the correctness of the coin submitted to their assay, both in weight and fineness, they shall deliver their verdict of acquittal. The jury then retire, accompanied by an officer of the exchequer, to where the coins are carefully weighed by the standard weights, and then a part of the gold and silver coin in the pyx is rolled under enormous pressure into two distinct masses of ingots, the metal of each being completely mingled and welded together. A piece is then cut off from the end of each ingot, and passed between rollers till it is made into a long and narrow plate about the thickness of a shilling. A number of small pieces are then cut off each plate, and all are weighed with the greatest accuracy, and placed upon a piece of paper, which is numbered, and the weight of the standard metal written upon it. Each piece of metal is then placed in a small bottle fixed in hot sand baths, and filled with sufficient acid to extract and dissolve the alloy. When nothing but the fine gold or silver remains, each piece is taken out of its bottle, again carefully weighed, when the weight of the fine metal is again written down on the paper bearing its number. The proportion of gold or silver and of alloy can thus be calculated and accurately determined in a number of cases, and from these a just result is obtained of the proportion of fine metal and of alloy in the whole of the money in the pyx, and consequently of the amount in the whole coinage which they represent. The same process is applied to the trial pieces of standard gold and silver delivered to the jury for this purpose, and the same results of the proportions of fine metal and of alloy ought to be obtained, in order to prove the complete accuracy of the assay, and to insure a satisfactory verdict of the requisite fineness of the gold and silver coinage. A very small variation in the standard is allowed in the Coinage Act, called "the master's remedy." This minute variation (one-twentieth of a carat per pound of gold, and one pennyweight per pound of silver) has never been exceeded, so far as the records extend, since the date of the first mint indenture in 1290.

Q

Q is a superfluous letter of the alphabet, having the same sound as *k*, though limited in English to words in which *u* follows. In French it occurs at the end of words, as *cing*, &c. In such cases the word usually represents a curtailed Latin word (*quinque*, &c.) This letter furnishes evidence that the alphabetical characters were originally of syllabic power. Thus the Hebrew koph and the Greek koppa, **Q**, appear to have been used only in those words where the sound of *o* follows, as in *Kos*, *Korinthos*, *Surakosioi*, &c. Indeed, the name of the letter implies as much. The Greek alphabet probably stopped at one time, like the Hebrew, at **τ**, so as to have

no *u*. On the other hand the Etruscan alphabet had a *u* but no *o*. Hence in Italy the *q*, which by position in the alphabet corresponds to the Greek koppa, was limited to words where a *u* followed. In the same way the kaph of the Hebrew and kappa of the Greek were probably at first limited to those words where a *u* follows, as we know was the case in Latin, and as the modern name of the letter, *ka*, denotes, for it would otherwise have been called *ke* or *ek*. This view becomes more complete if it be called to mind that the name of **χ** (*chi*) connects it with the vowel *i*; and that the **η** or **Η** of the Greek alphabet was originally a guttural aspirate, sounded perhaps as **χη**, and this was

adopted to denote either a guttural consonant or a long *e*. Although *q* is generally followed by a second vowel after its *u*, the older practice of the Romans did not so limit its use. Thus, *pegunia*, *pequdes*, *qum*, *equs*, are met with in the oldest inscriptions. The tendency in Latin was to get rid of the letter wherever possible. Thus, the antique *quojus*, *quoi*, *quur*, &c., became, as time went on, the familiar *cujus*, *cui*, *cur*, &c. The participle of *sequor* is *secutus*, of *relinquo* is *relictus*, and so on.

Q in Latin took largely the place of *p* and *t* in Greek; thus, *Gr. pente*, Lat. *quinque*; *Gr. hippos*, Lat. *equus*; *Gr. tis*, *tettara*, Lat. *quis*, *quatuor*, &c.

It changes frequently into *c* in the Romance tongues; thus, Lat. *cognatus*, *antiquus*; Ital. *cucuo*, *antico*; Lat. *quomodo*; Ital. *come*; Fr. *comme*, &c. Or into *g*, as Lat. *equalis*; Fr. *égal*. Or it is omitted, as Lat. *agua*, *fucus*; Fr. *eau*, *fin*.

Among the abbreviations of *Q* are S.P.Q.R. (Senatus populusque Romanus); Q.E.D. and Q.E.F. (*quod erat demonstrandum*, *faciendum*, which was to be proved, or constructed), the formulae closing a mathematical theorem or problem respectively; Q.S. (*quantum sufficit*, as much as is necessary); and Q.V. (*quod vide*, which see, a reference to another article or book).

The name "*cue*" applied to the letter is probably the French *queue*, a tail, as the form of the letter is *Q* with a tail. The letter came into English use only through the Normans, who brought it from France.

Q'AN'ON or **KANOON** is the name of a musical instrument special to the Arabs and Persians. It is a kind of dulcimer, and dates from a very great antiquity. The finest specimen of those at South Kensington Museum is inlaid on the front and sides with mother-of-pearl, and measures a little over 3 feet by 1½ foot. This particular q'anon is of modern construction. The strings are of gut and are twanged with two small plectra, one on each forefinger; herein the q'anon differs from the *santir*, which is a similar instrument, having wire strings and played with drumsticks. The favourite plectra for the q'anon are of tortoiseshell, with cocoa-nut shell points. The number of strings is usually seventy-five, three to a unison; giving, therefore, twenty-five separate notes. The tuning is very curious. It may best be imagined as in the key of D, beginning on the second of the scale instead of the key-note, and extending from E below the bass stave to *a'* above the treble stave.

Q'IT'AR, the Persian variety of the guitar, the belly being replaced, as in the banjo, with a thin parchment or bladder. It has five strings of thin wire. Another name for this instrument is *njuk*.

QUA'DI, a branch of the Suevic division of the Teutonic family in the middle and later times of the Roman Empire. They and their neighbours on the west, the Marcomanni, lay beyond the Danube, on the frontiers of the empire, and the two German nations jointly waged war against Rome in the time of Marcus Aurelius. That emperor won a great victory over the Quadi in 174. A curious circumstance in the campaign was the salvation of the Romans from great danger through a sudden attack, by means of a storm which burst upon the Quadi while they, the Romans, were surrounded by fine weather. The "thundering legion" which was engaged did *not*, however, derive its name from this occurrence, as it already bore that title on account of the device on its shields a great many years before. Neither is the alleged fact of some legionaries who were Christians having wrought this miracle by their prayers borne out by any evidence at all. It will be remembered that the first book of the immortal "Meditations" of the great and good Emperor Marcus Aurelius is dated "from his tent before the Quadi."

QUADRAGES'IMA (Lat. "fortieth"), the first Sunday in Lent, which is about the fortieth day before Easter.

QUAD'RANGLE or **QUADRAN'GULAR** (Lat. *quadrangulus*), and **QUADRILAT'ERAL** ("four-angled" and "four-sided"). These terms are indiscriminately used to denote a figure with four sides in the same plane.

QUAD'RANT (Lat. *quadrans*, a fourth part), literally the fourth part of a circle, or 90 degrees. This term is now applied to an astronomical instrument once used in the determination of angular measurements, and which consisted of an arc of a circle, equal to the fourth part of its circumference, and divided into degrees and parts of degrees. Ptolemy (circa 150 A.D.) made use of a stone quadrant, with the gradations marked on its polished side; it was fixed in a meridian plane, with one radius vertical and the other horizontal. Picart, in his measurement of the earth, employed a quadrant for his terrestrial angles. In 1725 a mural quadrant, by Graham, was erected in the Greenwich Observatory, but replaced in 1750 by Bird's, with which Bradley effected his successful observations. Owing to certain inherent defects, the quadrant has of late years been entirely superseded by the mural circle, which has been found much more accurate in results.

Hudley's quadrant, or more accurately *octant*, in its principle and application, is the same as the sextant, to which it has given place. See **SEXTANT**.

QUAD'RANT ELECTROM'ETER. See **VOLTAIC ELECTRICITY**.

QUADRAN'TAL (*amphora quadrantal*), the ancient Roman standard fluid measure. The standard quadrantal was very strictly guarded in the temple of Jupiter on the Capitol. It contained 5·77, say 5¾, English imperial gallons.

QUADRAT'IC, **BIQUADRAT'IC** (Lat. *quadratum*, a square), names given to algebraic expressions, the highest powers of which are the square, and the square of the square, or fourth power, of the letter with reference to which the expressions are considered. The solution of quadratic equations, i.e. equations containing some quantity raised to its second power, form the subject of one of the principal chapters in works on algebra.

QUADRATIC SYSTEM OF CRYSTALS. See **CRYSTALLOGRAPHY**.

QUADRA'TRIX, any curve which is useful in the quadrature of other curves. One useful quadratrix is that of Dinostratos, to the following equation—

$$y = (a - x) \sin \frac{x}{a} 90^\circ,$$

which curve being given, the ordinate, when $x = a$, determines the length of the circumference of the circle whose radius is equal to *a*. For, make a rectangle on this ordinate equal to the square of the diameter, and the other side of that rectangle is as long as the circumference of the circle. Tschirnhausen's quadratrix has this equation—

$$y = a \sin \frac{x}{a} 90^\circ,$$

which curve being given, draw a tangent at the origin, and construct a right-angled triangle with part of the tangent for the hypotenuse and part of the axis for a base: then the third side of this triangle is the quadrant of a circle which has the base for radius. These are very ingenious devices, but as means for obtaining knowledge they fail by assuming the very point they profess to determine.

QUAD'RATURE. By the quadrature of a curve is meant the finding of a square equal to the content inclosed by the curve; but as every rectilinear figure can be immediately converted into a square of equal magnitude, the object is gained as soon as any rectilinear figure is found of the same content as the curve. This is the geometrical quadrature of a curve. The arithmetical quadrature is the determination of the area inclosed by

Nevertheless the ratio was consecutively carried to seventy-five places by Abraham Sharp, to 100 by Machin, and to 128 by De Lagny, and at the end of the last century to 140 places by Vega. Baron Zach informed Montucla that he had seen a manuscript in the Radcliffe Library at Oxford in which it was carried to 154 places.

Vega's result, which, as far as it goes, is confirmed by those of Machin and De Lagny, is as follows:—

3·14159	26535	89793	23846	26433	83279
50288	41971	69399	87510	58209	74944
59230	78164	06286	20899	86280	34825
34211	70679	82148	08651	32823	06647
09384	46095	50582	26136		

But the Oxford manuscript gives as the ending (according to Montucla)—

46095 50582 23172 (53594 08128 4802)

So far as these agree there is no doubt of their correctness, so that the approximation was carried to 135 decimals certain. In the year 1841 Dr. Katherford communicated to the Royal Society 208 places of decimals. About 1846 Mr. Dase calculated 200 decimals, and Dr. Clausen, of Dorpat, 250 decimals, by two methods. In 1851 Mr. W. Shanks, of Houghton-le-Spring, Durham, extended the calculation to 527 decimals, and two years afterwards to 607, giving the result in his "Contributions to Mathematics" (London, 1853).

A few words may serve to prevent some one from making an attempt upon this enchanted castle, as it is supposed to be. When the difficulty first began to be noticed, the circle stood alone among curves; and so remarkable a distinction between this, the only curve then considered, and rectilinear figures, the only other figures then considered, could not but excite curiosity. The position is now changed. Not only does the now well-recognized distinction of commensurable and incommensurable prevent the circle from presenting anything peculiar to itself, but the curve is only one among an infinitely great number, many of which have been investigated and their properties examined. Consequently, with reference to the present state of mathematics, the problem analogous to that of squaring the circle is, "Given any curve whatsoever, to find its area." Now if the ingenuity which is guided by the love of investigating hidden things should desire a field for its exertions, let it leave that of the circle, which has been cropped until it will yield no more, and, first acquiring sufficient mathematical knowledge, let it spend its force upon some one of the many real difficulties which abound both in the pure and mixed sciences: let it investigate the meaning of divergent series, for example, in all their various varieties, or endeavour to extend the theory of discontinuous expressions, or solve the equations of motions of the solar system by some other method than that of series. For one point that should strike the lover of the marvellous in the quadrature of the circle, there are hundreds in the above-named subjects which surprise the mathematician.

QUADRIFRONS, an epithet of the Roman god Janus (*Janus*), whose two-faced image was sometimes converted into a four-faced figure, so that the four points of the compass and the four seasons of the year might be guarded by his influence.

QUADRI'GA, a four-horse chariot used by the ancients. The two strongest horses were put one each side of the pole of the chariot, and the other two outside them, and pulling by traces, so that all four horses were in one row.

QUADRILATERAL is a term in fortification describing four fortresses capable of affording mutual support; and the immense strength of such a combination is shown by the famous Quadrilateral in Northern Italy, whose strength alone maintained the plain of Lombardy in obedience to the foreign rule of Austria, foiled all the strength of France in 1859, and served to overthrow Italy in 1866 at a time when but little force could be spared by Austria from the life-and-death struggle with Prussia to the northward. The four towns forming the Lombard Quadrilateral are Peschiera, on Lake Garda, where the

Mincio flows from it; Mantua, on the lake formed by the Mincio shortly before it flows into the Po; and opposite to these Mincian fortresses two upon the Adige, Verona to the north, Legnago to the south.

QUADRILLE, a card-game for four players (Ital. *quattro*, four), or a contredanse for four couples.

1. The game of quadrille succeeded *ombre* (or *hombre*) in favour, the latter chiefly differing in being played by three persons. *Ombre* was the favourite game in Queen Anne's reign, and quadrille in the reign of her immediate successors. In both games the eights, nines, and tens are thrown out of the pack. Pope's description of *ombre* in the "Rape of the Lock" is one of the finest mock-heroic pieces in literature, and serves equally well for a description of quadrille.

Let spades be trumps, she said, and trumps they were.
Now move to war her sable matadores.
In show-like leaders of the swarthy Mous. •
Spadillo first, unconquerable lord,
Led off two captive trumps, and swept the board.
As many more Manillo forced to yield,
And marched a victor from the verdant field.
Him Basto followed, but his fate more hard,
Gained but one trump and one plebeian card.
With his broad sabre next, a chief in years,
The hoary majesty of spades appears,
Puts forth one manly leg to sight revealed.
The rest his many-coloured robe concealed, &c.

The matadores are the three highest trumps; Spadille, the ace of spades, always the highest card whatever the trump suit may be; Manille, the next highest card, is the deuce of spades or clubs, or the seven of hearts or diamonds, whichever are trumps; Basto is always the ace of clubs, and is the third highest card; Ponto, the ace of a red suit, is the fourth highest card when a red suit is trump. When the black suits are not trumps the cards rank as in whist, but when they are trumps the deuce becomes Manille. When the red suits are not trumps they rank king (highest), queen, knave, ace, deuce, &c., down to seven (lowest); but when they are trumps the seven become Manille and the ace becomes Ponto, and is fourth trump after Spadille, Manille, and Basto: in this case there are thirteen trumps. The player who has the lead chooses which suit he prefers for trumps. These rules are the chief ones, and are sufficient to understand the many allusions to the peculiarities of quadrille and ombre in the Queen Anne and Georgian literature; but many minor complications must be mastered before the game can be played.

2. The "country dance" (*contredanse*), or rather the group of dances called quadrille, was at first called *Quadrille de contredanses*, differing from the usual country dances in being danced in square. It grew up in the renewal of gaiety at the close of the terror of the French Revolution, and took its final shape in Paris under Napoleon I. Lady Jersey brought it to the court of George IV. about 1815, and it at once attained popularity. The first figure, *Pantalon*, was a dance whose original tune was an old ballad "Le pantalon de Madelon n'a pas de fond," &c. The second figure, *L'Été* (summer), was a very favourite *contredanse* of the consulate: a quite different figure is now substituted, less difficult, but also less graceful than the original. The third figure, *La Poule* (hen and chicken), dates from 1802. The fourth figure, *Trenise*, was named after a great dancer, Trenitz; it has been superseded by another dance, *Pastourelle* (pastorale). The last figure is called *Finale*, and was composed to give a brilliant finish to the collection of dances.

QUAD'RIREME, an ancient war-galley with four banks of oars. See TRIEME.

QUADRIV'UM, the university course of knowledge in the dark ages, comprising the four branches of arithmetic, geometry, music, and astronomy. The trivium comprised the three sciences of eloquence—grammar, logic, and rhetoric. Combined they gave the "seven arts" or faculties.

QUADROON' (*Quarteroon*), the name given in America to the descendants of a mulatto or creole and a white. The descendants of a quadroon and a white are called *octeroon*.

QUADRU'MANA was the name given by Cuvier to a section of the order Primates of Linnæus, containing the monkeys and lemurs, man being separated as a distinct order, Bimana. See PRIMATES.

QUAD'RUPLE ALLIANCE. This was the title given to the alliance between Great Britain, France, Austria, and the United Provinces of the Netherlands formed in London by treaty, 2nd August, 1718. See PHILIP V. of Spain.

Quadruple Treaty was the name given to that concluded between Great Britain, France, Spain, and Portugal 22nd April, 1834, in support of Queen Isabella of Spain and Queen Maria da Gloria of Portugal.

QUAD'RUPLE COUNTERPOINT is counterpoint of four parts so constructed that all the parts will bear transposition in any order whatever. It is only possible at the octave, and therefore gives twenty-four different inversions or arrangements. See COUNTERPOINT.

QUAD'RUPLE TELEGRAPHY, the combination of the *duplex* and the *diplex* systems. The first enables the operators at two ends of a wire to telegraph in opposite directions simultaneously; the second enables two messages to be sent along a wire at once, and in the same direction. In quadruplex telegraphy two sets of instruments are used on one and the same line; one set works by a polarized relay (diplex), and therefore comes into action only when the direction of the current is changed, and the other set works with a non-polarized relay adjusted with springs weighted to move only with a certain minimum force, so that it comes into action when the strength of the current is changed, and is independent of any change of direction.

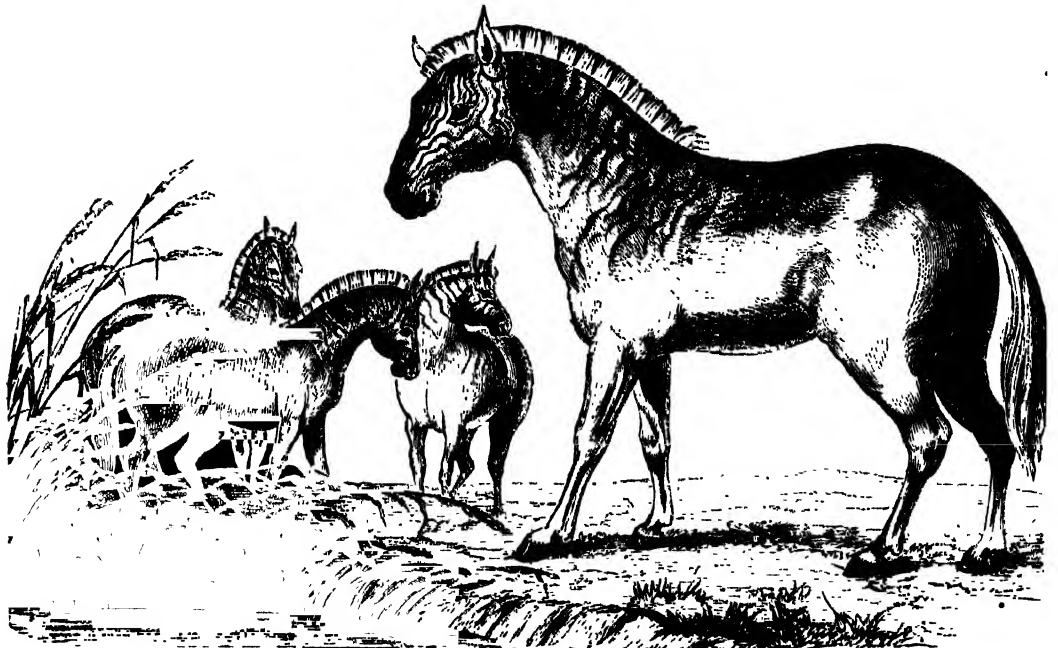
QUÆS'TOR (Lat. *quæro*, I search out, examine),

a name which was common to two distinct classes of officers at Rome, who were only distinguished from each other by different attributes: one class was *Quæstores Parricidii*; the other, *Quæstores Classicæ*.

The origin of the *Quæstores Parricidii* was traced by some writers to the earliest period of Roman history. Their functions related to the prosecution of persons who were guilty of capital crimes. They are not mentioned after 363 B.C., their functions devolving upon other officers.

The *Quæstores Classicæ* had the superintendence of the public treasury, and are said to have been instituted by Valerius Publicola, who gave the right of electing them to the people. At first there were two, both patricians; in B.C. 421 two additional ones were appointed to accompany the consuls to the field and act as guardians of the military chest—the two chief *quæstores*, who stayed at Rome, receiving the special name of *urbani*, the "city quæstores." By about the year 409 the plebeians succeeded in carrying the *quæstorship*. In the year 265 B.C. the number of *quæstores* was raised to eight, the state now being so large. Sulla raised the number to twenty, as the office qualified for the senate; Cæsar raised it to forty. Under the emperors the number varied. Every proconsul, prætor, &c., was accompanied in his province by his *quæstor*. The two *quæstores urbani*, down to the time of Julius Cæsar, had the administration of the public treasury; they registered the revenue and expenditure of the republic, received the money due to the state, and made the payments which were sanctioned by the senate. The military *quæstores*, who accompanied the consuls to the field, had the charge of the military chest and the superintendence of pay, provisions, and of the booty acquired in war. They had to give in their accounts to the treasury at Rome. The *quæstores* took their seat in the senate after their year of office was over.

QUAG'GA (*Equus quagga*) is a species of the family Equidæ, nearly allied to the horse, ass, and zebra. The



Quagga (*Equus quagga*).

quagga is a native of South Africa, having been at one time found in vast herds on the plains south of the Vaal

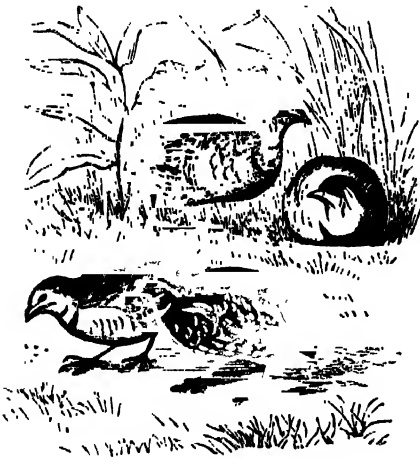
River, but it has now become very scarce. The ears and tail resemble those of a horse. The neck is fur-

nished with an erect mane, banded alternately brown and white. The upper parts of the body are reddish-brown, the head, neck, shoulders, and flanks being marked with dark stripes, which become fainter as they approach the middle of the back. There is a broad dark stripe along the back. The chest, belly, legs, and tail (except at the root) are white. The quagga stands about 4 feet 4 inches high at the shoulder. It is frequently found in the company of the gnu and the ostrich. It utters a shrill barking neigh, the sound of which is imitated in its common name. Quaggas have been driven in harness in London.

QUAICH or **QUEGH** (sometimes *Queff*) is the name of an antique Scottish drinking-cup with two handles. The word is a Lowland modification of the Gaelic *cuach*, cup, bowl, and when the guttural was softened into *ff* gave the English word *quaff*, to drink large draughts, such as would be demanded of one to whom the great quail was passed at the feast.

QUAIL (*Coturnix*) is a genus of game-birds belonging to the family **TETRAONIDÆ**. The quails are nearly allied to the partridges (*Perdix*), but have longer wings, a shorter tail, and a more slender bill.

The Common Quail (*Coturnix communis*) is about 7½ inches in length. The plumage of the upper parts in the male is reddish-brown, with numerous streaks of buff; the under surface is buff, passing into white on the belly; the throat has two narrow bands of reddish-brown. The female is not quite so bright in colour, and lacks the marks on the throat, while the breast is spotted. The quail is a summer



Common Quail (*Coturnix communis*).

visitor to Great Britain, though a few remain during the winter. They arrive in this country in May, and migrate southwards towards the end of September or the beginning of October across the Continent and the Mediterranean into Africa. Vast numbers are seen on the shores of the Mediterranean during their migration, especially in the autumn, and in Southern Europe a considerable number are resident throughout the year. In the Azores and Madeira there is a smaller resident variety with a conspicuous red throat, which produces two or even three broods in the year. This is the bird referred to in the Book of Exodus as furnishing the Israelites with a supply of animal food during their journeying in the wilderness. In May or June the quail lays its eggs in a hole scraped in the ground, generally in a corn-field, and lined with bits of grass, straw, &c. The eggs are from nine to fifteen in number, yellowish-white, blotched and speckled with dark

brown. These birds are often said to be polygamous, but they probably pair. Their flight is rapid, straight, and low. The cry of the male is a shrill triple note, whence the bird is known in some parts of England under the names *Wet-my-lips* or *Wet-my-feet*.

In China the males are kept in captivity for the purpose of fighting, which they do with great courage, and the people are said to stake large sums upon the issue of these contests. A similar practice prevailed to a great extent among the ancient Greeks and Romans, and is said not to have entirely died out among their descendants.

During their annual migrations enormous numbers are netted for the table in the south of Europe. The flesh, especially of those taken in the autumn, is of good quality. An allied species, the Black-breasted or Rain Quail (*Coturnix coromandelica*) occurs in India, as well as the common species. Other species occur in Asia, Australia, and New Zealand.

America has some allied species of quails. The Virginian Quail (*Ortyx virginianus*) is widely distributed in North America, being called Partridge in some parts. This bird frequents woods and plantations. Its nest is carefully made under the shelter of a thick tuft of grass; it is composed of leaves and grass, and is covered above with an opening on each side. It is in some places called Bob White, from the call-note of the male. The Californian Quail (*Lophortyx californica*) is distinguished by having its head adorned with a crest of elongated black feathers, erectile at pleasure. Attempts have been made, though without success, to introduce both these birds into England.

The **HEMIPODES** (Turnix), which belong to a separate family, Turnicidæ, are often called Quails or Button-quails.

QUAKERS. See **FRIENDS, SOCIETY OF.**

QUAKING GRASS is the name given to the various species of GRASSES belonging to the genus *Briza*. Their dense clusters of flowers are suspended upon the ends of an extremely delicate filamentous peduncle, forming an elegant panicle, which shakes with the slightest breath of air; hence the name quaking grass. There are two British species, *Briza media*, common in England, Scotland, and Ireland, and *Briza minor*, occurring locally in the south of England. Both the species grow in pastures, but do not yield much nutriment. Most of the species are South American, and some are cultivated in gardens as ornamental plants.

QUALITATIVE and QUANTITATIVE ANALYSIS. See **ANALYSIS (III.)**

QUALITY (Lat. *qualis*), in the common acceptation, comprises all attributes that can be given to a thing, with the exception of those of magnitude and quantity—whether the attributes are essential to the thing or merely accidental. But in speaking of the qualities of things, we chiefly consider those by which they are distinct from other and similar things.

QUALITY, as applied to musical tone, otherwise called *timbre*, *tone-colour*, and (by Professor Tyndall) *clang-tint*. See **ACOUSTICS**.

QUAMASH' (*Camassia esculenta*) is a North American plant, belonging to the order **LILIACEÆ**. It occurs in great abundance on the swampy plains of the north-west coast, and its bulbs form part of the food of the natives of those regions. The bulbs are dug up immediately after the plant has flowered, and prepared for food by being baked in a hole in the ground and either used at once or pounded into cakes. The plant has large, very narrow leaves and flower-stalks a foot or more high, bearing from twelve to twenty blue or white flowers.

QUANTIFICATION OF THE PREDICATE is an innovation in logic made chiefly by Sir William Hamilton, though the main outlines were published by George Bentham in 1827. In the proposition "All men are mortals," the sense differs very much according as the pro-

dicate signifies "all mortals" or "some mortals." In the first case men would exhaust the class of mortals, in the second case men would be only one part of the class of mortals. Aristotle, indeed, assumed that affirmative propositions always had a particular predicate; that, in fact, "all men are mortals" meant "are some mortals," and that only negative propositions had universal predicates. But such propositions as "All equilateral triangles are equiangular," "London is the capital of England," &c., have strictly universal predicates, that is, the subject exhausts the whole of the predicate. One effect of quantifying the predicate is to allow of conversion by *simple conversion*, and to set aside altogether *conversion by limitation*. Thus "All men are (some) mortals" converts simply into "Some mortals are all men." Again, though we cannot assert from "All men are mortals," in its unquantified form, more than that "No immortals are men" as a contrapositive; yet on quantifying it in the form "All men are (some) mortals," we can not only say "No immortals are men," but also "What are not men are not some mortals."

It is clear that with quantified predicates there are eight kinds of propositions, taking the following form—

All X is all Y.	No X is (any) Y.
Some X is some Y.	Some X is not some Y.
All X is some Y.	No X is (some) Y.
Some X is all Y.	Some X is no Y.

Where X is subject and Y predicate, Boole's most ingenious system of logic regarded as a branch of mathematics is founded upon this idea of the quantification of the predicate. In fact, the necessity of it is so self-evident, that it seems remarkable that it did not occur to Aristotle when founding the science.

QUANTITY, in logic, is that division of propositions which separates them into universal and particular by their predicates. If the subject includes the whole of the predicate then the proposition is universal; if only part, then it is particular. See **QUANTIFICATION OF THE PREDICATE**, and the general article **LOGIC**.

QUANTITY, in poetry, is the distinction between long and short syllables, and applies chiefly to the prosody of the Greeks and Romans. Our own poetry is regulated by accent or stress, and not by quantity. See **FOOT**.

QUANTITY (of heat and electricity). The *quantity of heat* must be regarded as quite distinct from the temperature. To know how hot a thing is (temperature) does not in the least mean that we know how much heat it has taken to raise it to that hotness. Thus, melting ice and freezing water are both at 32° of temperature; but the latter contains considerably more heat than the former. As a rule the quantity of heat absorbed to raise a body say 5° will be given out again when that body falls the same degrees in hotness. Also the quantity required to raise 2 gallons of water one degree is double that required for one gallon. But it is not at all the same thing to say that as much heat is required to raise a gallon of water from 50° to 31° as is required to raise it from 50° to 51°. In point of fact these frequently differ very largely. The capacity for absorbing quantities of heat varies with different substances, and constitutes their *specific heat*, water being taken as the standard of comparison. A body requiring twice as much heat to raise an ounce of it from 50° to 51° as is required to raise similarly an ounce of water, would be said to have a specific heat of two.

Quantity of electricity is measurable by units, the unit of quantity being that amount which, when placed at a distance of one centimetre from a similar and equal quantity, repels it with a force of one dyne.

QUANTITY ARRANGEMENT OF CELLS, in voltaic electricity, is that arrangement whereby, instead of the zinc of each cell being united to the copper of the next,

all the zincs are united separately, and all the coppers are also united separately. Thus, a single large zinc plate and a single large copper plate are, as it were, provided. The result is to reduce the internal resistance. Four cells thus joined will have only one-fourth internal resistance of one cell; but, on the other hand, the electro-motive force (E. M. F.) of the four will be no greater than that of one cell. The "arrangement for quantity" is also called "arrangement in compound circuit."

QUANTOCK HILLS, an English range of hills in the county of Somerset, running S.E. from Watchet, on Bridgewater Bay, towards Taunton. The Devonian formation prevails, and the elevation is 1428 feet.

QUARANTINE (Ital. *quaranta*, forty), according to the customs which formerly prevailed, was the term during which a ship arriving in port and suspected of being infected with a malignant contagious disease, was obliged to forbear all intercourse with the shore. The contagious disease which quarantine regulations in this country were intended to guard against in the earliest times was the **PLAGUE**, and to this the yellow fever and cholera were afterwards added. Whenever a vessel arrived which had sailed from the Levant or from any country where the plague was known to prevail, such vessel was invariably suspected, the crew and passengers being required to pass a certain period in a building set apart for the purpose, called a Lazaretto, in which also the merchandise brought was exposed for purification. This period was generally fixed at forty days, but there were many variations from this rule, the passengers and crew being often allowed to leave after a shorter detention, while merchandise might be kept for a longer period. A distinction was drawn also between different articles of merchandise imported, two classes of goods being recognized, *i.e.* those supposed to be capable of transmitting disease, termed *susceptible*, and those by which it was supposed infection was never conveyed, and which were designated *non-susceptible*. The grounds of the distinction made were somewhat fanciful: all animal substances, such as wool, silk, and leather, and many vegetable substances, such as cotton, linen, and paper, being deemed susceptible, while wood, metals, grain, and fruits were regarded as non-susceptible. The favorite form of the lazaretto was that of a floating hulk, moored a short distance from the shore, and several such establishments were formerly maintained round the coasts of the United Kingdom, but the only one now existing is that of the Motherbank, near Spithead. It consists of three dismantled men-of-war, under the charge of a superintendent of quarantine, a crew, and all necessary convenience for receiving and treating sick persons, and for disinfecting infected vessels. It is evident that circumstances might occur which would make the possession of such an establishment of great advantage, as when in 1873 the *Johanna* arrived from St. Domingo with almost all on board suffering from yellow fever; but happily such events are of rare occurrence, and the vessels off the Motherbank have only been called into requisition on twelve occasions during the past twenty years. Although the old quarantine laws have never been repealed, quarantine, in the original sense of the term, has long been obsolete in the United Kingdom, but the name is still retained in common usage for the modern substitutes now generally adopted for the old practice. In Great Britain the modern system is to detain no ship in quarantine unless there be some form of infectious sickness on board, or there has been such during the voyage. It is the duty of the officers of customs to board every ship arriving from abroad, and to question the master as to the port sailed from, as to whether any sickness prevailed there at the time of sailing, whether any of the officers, crew, or passengers have suffered from any kind of illness during the voyage, and as to the condition of health of every person on board. A refusal to answer

any of these questions, or the giving of a false answer, subjects the master to a penalty of £100, while the customs officer, by virtue of his Quarantine Commission, if he suspects the existence of cholera or other infectious disease, may at once detain the vessel and apprise the local authority, in order that a proper medical inspection may be made. By the Public Health Act, the sanitary authorities of each port are empowered to deal with all ships having a communicable disease on board, the details of the medical inspection, &c., being set forth in an Order of the Local Government Board, dated 17th July, 1873. The essential difference between the old quarantine and the modern practice is that instead of unenforced detention of ship and crew under all circumstances, now a ship is only detained when reported, and then only until it can be properly inspected, the sick (if any) removed to hospital, and the necessary processes of disinfection carried out.

The relative advantages of medical inspection and of quarantine were for a considerable period subject of much debate, but at the International Sanitary Conference, which was held at Vienna in 1874, the principle of inspection with the isolation of the sick was accepted by the large majority of the delegates, including those from every state of the first rank except France. The minority, while adhering to quarantine, agreed to a system by which its stringency, as before practised, was much diminished. It is only in Spain and Portugal in the west, and in Turkey and Greece in the east, of Europe that the old quarantine traditions are retained, and where ships coming from suspected ports are detained in the old fashion. In Portugal, owing to the constant trade with the Brazils, where yellow fever is endemic, the quarantine regulations are very strict, and during nine months of the year all ships, passengers' luggage, and cargo from Brazil are subjected to detention for a period longer or shorter according as the port of sailing is considered infected or suspected. Generally the passengers and crew are required to spend from five to seven days in the lazaretto, and all "susceptible" articles are subjected to a fumigation with chlorine. At the port of Lisbon is erected the largest lazaretto in the world. It is situated about 4 miles below the city, and its various buildings cost over £200,000. In Spain the chief quarantine stations are at Vigo for the Atlantic seaboard, and at Port Mahon for the Mediterranean coast.

The experience of recent years seems to prove that the practice of inspection, coupled with the removal and isolation of the sick, is sufficient to prevent the importation of an epidemic; but in times of cholera panic many of the countries of the Continent fall back upon some modification of the old system. In such cases "a land quarantine" is enforced as well as a maritime one, and all persons passing from one country to another are detained and fumigated. In 1884 a land quarantine was imposed by Italy against France, and in 1885 another was imposed by Portugal against Spain.

In law the term quarantine is used to designate the period of forty days during which a widow is entitled to remain in her husband's dwelling-house after his death.

QUARE IMPEDIT. When an ecclesiastical benefice becomes vacant by the death, cession, &c., of the incumbent, unless the patron [see *ANOWSON*] present his clerk, that is, a clergyman, to the bishop of the diocese for institution within six calendar months, the right will lapse to the bishop, who may collate to the vacant benefice. But if a presentation be made by the patron within the six months, and it is rendered ineffectual by the bishop's refusal to institute the clerk, the patron may obtain redress in an action of *quare impedit*, a proceeding so called because the writ by which the action was formerly commenced requires the defendant to state *quare impedit* (why

he hinders) the plaintiff from exercising his right of presenting to the vacant benefice.

The patron only, and not the clerk, can maintain an action against the disturber. But under several statutes passed in the reigns of James I., William and Mary, and Anne, which took away the right of presentation from Roman Catholic patrons, the clerks presented are empowered to take certain proceedings in support of their interests. The right of presenting to benefices belonging to Roman Catholic patrons is vested by those statutes in the universities of Oxford and Cambridge, according to a distribution of counties given in the Act of James I.

QUARLES, FRANCIS, was born in 1592, of a good family in Essex, educated at Christ College, Cambridge, and entered at Lincoln's Inn. He came into favour at court and was cupbearer to James I.'s daughter, the Queen of Bohemia. In 1640 he became chronologer to the city of London, and remained so till his death. In 1611 he was Archbishop Usher's secretary, but the Irish rebellion forced him to flee to England, where he was persecuted for his attachment to King Charles. He died 8th September, 1614.

His works are now neglected, with two exceptions, that of his "Emblems," which have been many times reprinted, and are sought after by some for their quaintness, by others for their piety—a poetical paraphrase of the "Pia Desideria" of the Jesuit Hango; and a prose collection of 100 maxims called "Enchiridion," remarkable for their terseness, their variety and originality, and quaintness without excess. Quarles had eighteen children, of whom one inherited some of his father's poetical genius, shared the royal fortunes, and died of the plague in 1665.

QUARREL (the Old French *quarreau*, now *carreau*), the arrow or bolt, with a square based pyramidal head, discharged from the crossbow in mediæval warfare. The word comes from Lat. *quadrus*, a square. Diamond or lozenge-shaped window panes are also called quarrels.

QUART, the same word as quarter, but always used (in our language) for the quarter of a gallon. See *GALLON*.

QUARTER, a term in very general use in naval phraseology. The *quarters* of a ship are her sides from the stern to about a fifth or fourth part of her length, and are distinguished as *port-quarter* and *starboard-quarter*. *Quarter-gallery* is a small balcony on the quarter of a ship, which generally communicates by doors with that on the stern. *Quarter-bill* is a written list containing the different stations where the officers and crew are to take post in time of action. *Quarter-gunner* is a petty officer under the direction of the gunner of a ship of war. One of these quarter-gunners is allowed to every four guns. *Quarter-men* are officers under the master shipwright, who are appointed to superintend the workmen in repairing ships of war. *Quarter-rails* are narrow moulded planks reaching from the top of the stern to the gangway, and serving as a fence to the quarter-deck. *Quarter-netting* is a kind of network extending along the rails on the upper part of a ship's quarter. *Quarter-wind* is a wind that blows directly on the ship's quarter. *Quarter-deck*, extending from the stern to the gangway, is used exclusively as a promenade for the captain and commissioned officers.

QUARTER, in war, is the act of mercy in granting life to a vanquished foe. To give such a one "quarter"—i.e. a military lodging—would of course imply the granting of the protection afforded to a prisoner, and hence the grant of life. It is rare now that generals are so bloodthirsty as to issue the stern command "no quarter."

QUARTER SESSIONS, GENERAL (of the peace), is the name given in England to a local court of record held once every quarter by two or more justices of the peace for the trial of such minor offences as come

within the jurisdiction of the court, and for the hearing of appeals from petty and special sessions. The hills of indictment for offences to be tried, and the witnesses, are taken before a grand jury, and if they find a true bill the trial proceeds, as at the assizes. The dates at which the sessions in the counties must meet are fixed for the first weeks after the 11th of October, the 28th of December, the 31st of March, and the 21st of June, but the justices may direct the April quarter sessions to be held any time between 7th March and 22nd April, so as not to interfere with the spring assizes. Quarter sessions in a city or borough depend upon the Municipal Corporations Act, 1882, 45 & 46 Vict. c. 50. In the counties the judges of quarter sessions are laymen and unpaid, though they are assisted in their labours by a qualified and paid assistant; but in the boroughs the courts are presided over by the recorder as sole judge, a paid official selected from barristers of five years' standing and upwards. In the boroughs the sessions must be held once in every quarter, but the date is fixed at the discretion of the recorder, and they may be held more frequently if the recorder think fit or a secretary of state so direct. The recorder has no power to grant a license for the retailing of excisable liquors, nor can he levy a borough rate. The quarter sessions of London, the counties of Middlesex, Kent, and Lancaster, and of the Cinque Ports, are governed by special legislation.

In Scotland quarter sessions were established by the Act of 1661, and the justices of the peace meet at the county town on the first Tuesdays of May, August, and March, and on the last Tuesday of October; but the jurisdiction of these courts is more limited than in England. In Scotland much of the work which in England devolves upon courts of quarter session is transacted by the sheriff of the county or the commissioners of supply.

In Ireland the chairman of quarter sessions is a professional lawyer, who receives a good salary for his services, and who is intrusted with an important civil jurisdiction resembling that of a county court judge in England.

QUARTER DAYS or TERMS, in England, are—(1) Lady Day, 25th March; (2) Midsummer Day, 24th June; (3) Michaelmas Day, 29th September; and (4) Christmas Day, 25th December; in Scotland—(1) Candlemas, 2nd February; (2) Whitsunday, 15th May; (3) Lammas, 1st August; and (4) Martinmas, 11th November.

QUARTERMASTER, the officer of a regiment whose duty it is to attend to the quarters for the soldiers, their provisions, forage, &c. His rank is that of a commissioned subaltern officer; and he is almost invariably promoted from the ranks, after having risen through the different non-commissioned grades to the rank of quartermaster, quartermaster-sergeant or sergeant, or sergeant-major. The daily pay of a quartermaster in the cavalry is 8s. 6d., and in the infantry 6s. 6d., rising by length of service to 12s. and 10s. respectively. After thirty years' service, including ten as an officer, he may retire with the honorary rank of captain. The *quartermaster-sergeant* is a non-commissioned officer appointed to assist the quartermaster in his various duties. His daily pay varies from 2s. 8d. to 3s. 9d.

In the navy the quartermasters are petty officers who superintend the stowage of provisions and ballast, and attend to the steering, ship's time, &c.

QUARTERMASTER-GENERAL, in the army, is an officer of high rank, whose business in the field is to plan and regulate the marches and encampments of an army; to ascertain and lay down the peculiar features of the localities through which the troops are marching; to fix upon the headquarters and places for the artillery and baggage, and to procure supplies of provisions and forage. He conducts all the correspondence on the above matters, and issues the routes for the march of troops; and he is presumed to be conversant with all subjects relating to

military science, and more especially with the geography and topography of the country through which the army is passing.

Every army has some officer of this department; from a brigado with a deputy-assistant quartermaster-general, to a complete army under the commander-in-chief, with a quartermaster-general, who is usually a general officer, and receives £632 per annum, in addition to his ordinary pay. There is also a permanent quartermaster-general at the Horse Guards, Whitehall, who is responsible for all the movements of the army, the organization of expeditions, camps, &c. In addition to his pay as a general officer he receives £1384 per annum.

QUARTERS, in military matters, a term applied to the stations or lodgings assigned to soldiers. Thus the headquarters of an army is the place where the commander-in-chief has his quarters, and the regimental headquarters is the station, generally in some town, where the colonel or commanding officer of a regiment may be quartered, with his staff of officers. Barracks are quarters assigned to particular regiments; and the apartments occupied by an officer in barracks are called quarters. These barracks exist in different parts of the country as quarters for soldiers, especially in the larger towns.

QUARTERSTAFF, a tough stout pole of wood from 6 to 8 feet long, and which sometimes had the ends loaded or shod with iron, formerly used as a weapon for hand to hand encounters in England. It was grasped in the middle with one hand, and between the middle and the end with the other, blows being given from either end of the staff as it was rapidly twirled round. In a quarterstaff encounter the antagonists used their weapons for defence as well as attack, and skilled players would sometimes hammer away for a good while without either receiving a blow, but one full rap received upon the head or hand was generally sufficient to decide the combat. The old Robin Hood ballads contain many descriptions of quarterstaff encounters, and in some of them the outlaws are represented as being worsted by shepherds, beggars, potters, &c., skilled in the use of this weapon. Down to the last century bouts at quarterstaff formed an appreciated element in the rustic sports of England, and they are even now occasionally revived for military assaults of arms.

QUARTER-TONES, intervals less than semitones, used formerly in the ancient Greek, and at the present day in the Arabic and other Oriental music. The modern Arabic scale in one of its varieties has twenty-four quarter-tones to the octave, and if these were equal each of them would be just half a semitone (equal temperament). The quarter-tone of the Greeks divided the true semitone of just intonation 15:16 into the two intervals 30:31 and 31:32. In each case the quarter-tones were (and are) used as grace notes only, not as regular intervals of progression.

QUARTET, in music, a composition arranged for four voices or instruments, each part being independent, yet all harmonizing and combining in the general theme. For stringed instruments quartets are usually arranged for two violins, a viola or tenor violin, and a violoncello. Among the most distinguished masters in this branch of composition we may name Haydn, its founder, Mozart, Beethoven, its greatest master, Schubert, Schumann, Mendelssohn, and Spohr. The quartets of Spohr, however, are rather in the nature of violin solos with string-accompaniments, whereas in the true quartet every part is of equal importance.

Quartets including a wind instrument are not so common; but pianoforte quartets, i.e. pianoforte, violin, viola, and violoncello, are a favourite combination with the great masters, as the contrast of pianoforte and strings, each division being complete in itself, is most effective, and their combination is extremely rich, and never suffers from that occasional thinness which affects the quartet proper to

modern ears used to the fulness of the pianoforte and the orchestra. On the other hand, the pianoforte quartet has not the exquisite clearness and purity of the true quartet, and is certainly the inferior form in art. The whole body of violins in an orchestra, including contrabasso, is often spoken of as the string quartet.

QUART-FAGOTT (German, Fourth Bassoon), a bassoon a Fourth lower in pitch than the ordinary bassoon.

QUART-FLOETE (German, Fourth Flute), a small flute a Fourth higher in pitch than the concert flute.

QUARTO, a book of the size of the fourth of a sheet; a size made by twice folding a sheet, which then makes four leaves. It is abbreviated thus, 4to. See PAPER.

QUARTZ is the term applied to the purer varieties of crystalline silica, and is one of the most universally distributed minerals. Besides occurring in distinct crystals and crystalline masses, it is the main constituent of all sandstones and grits, the ultimate particles of these rocks being minute grains of quartz enveloped in films of ferruginous and other mineral matter. It is also the material of which the more transparent, resinous-looking particles in granite and other igneous rocks are composed. The crystals of quartz are in the form of six sided prisms terminated by pyramids (or, more scientifically, terminated by the faces of two rhombohedra), and the sides of the prism exhibit prominent transverse striations. Such crystals, of small size, are abundant in many parts of Britain, and are popularly known by the name of Cornish diamonds, Bristol diamonds, or Buxton diamonds, &c., according to the locality whence they are obtained. They are also employed in making the cheap "diamonds" for cutting glass. Broken surfaces of quartz have a resinous lustre, and the mineral is so remarkably transparent that the larger masses have received the name of "rock-crystal," and are extensively used for ornamental and economic purposes. Waterworn pebbles of considerable size are imported in large quantities from Brazil (being known as Brazilian pebble), and are manufactured into spectacle-glasses and lenses for optical instruments.

Quartz is one of the most prominent minerals among the "veinstones" in mineral veins, and many of its varieties occurring in hollows and fissures are esteemed as inferior gems. Such are AMETHYST, CAT'S-EYE, CHALCEDONY, CORNELIAN, ONYX, AGATE, and JASPER.

QUARTZITE is a compact rock consisting of grains of quartz cemented together by the same material. It has thus a crystalline-granular appearance, and the colour depends upon the greater or less admixture of the oxides of iron and manganese or carbonaceous and clayey matter. When free from impurities it is of a dazzling whiteness. A fine-grained black variety is known as LYDIAN-STONE, and forms the "touchstone" of the jeweller: when gold and silver are rubbed upon a smooth surface the colour of the streak in each case enables an experienced eye to estimate the amount of alloy.

QUASS is a weak beer made in Russia from rye-mead fermented in warm water instead of from malted barley.

QUASSIA (a name formed in remembrance of a negro named Quassi, who first made known its medicinal virtues) is a genus of plants belonging to the Simarubaceæ. There is only one species, *Quassia amara*, a small tree from 10 to 15 feet high, found in tropical America and in some of the West Indian Islands. It has large pinnate leaves, the common stalk being winged and jointed, and terminal clusters of bright red flowers. The wood of the root of this plant was formerly in great repute as a stomachic and as a remedy for the malignant endemic fevers of Surinam. The flowers also were and still are, in that country, infused in wine or spirits, and form a bitter beverage. The wood, the Surinam quassia of commerce, is now little imported, its place being taken by the Jamaica quassia, furnished by an allied species, *Picræna excelsa*, which is more readily

procured. This species, the bitterwood, is a lofty tree occurring in the lowlands of Jamaica, and resembling the ash in general appearance. The wood has no odour, but an intensely bitter taste. It is imported in billets, sometimes a foot in diameter and several feet long; but before being used for medicinal purposes, they are cut into chips, which are of a light gray colour, or, by long exposure to the air, of a yellow or brownish hue. It is considered valuable in cases of weak digestion; a sweetened decoction is used for poisoning flies. Quassia is employed by brewers as a substitute for hops, in spite of the heavy penalties prohibiting this adulteration. Goblets of quassia wood are made, which impart tonic properties to the water they contain. The active principle of quassia seems to be *quassin*, a neutral substance which crystallizes in white prisms and is soluble in alcohol.

Simaruba bark is the rind of the root of another species (*Simaruba amara*) of this family, and has similar properties to quassia, though it also acts as an emetic.

QUASSIN or **QUASSIIN**, a bitter principle obtained from quassia wood, *Quassia amara*, natural order Simarubaceæ. It is an intensely bitter substance, crystallizing in white prisms, which melt when heated. It is soluble in water, alcohol, and ether. The formula is $C_{10}H_{12}O_8$. It is a pure bitter and a stomachic tonic.

QUATERNARY PERIOD, in geology, the name often applied to the span of time between the end of the PLEISTOCENE epoch and the present day. It is regarded as a term equivalent in rank to those of Tertiary, Secondary, and Primary, which are given to the preceding great divisions of geological time. Professor Boyd Dawkins, however, in a paper read before the Geological Society in 1880, has shown that there are no grounds for such a classification, and this distinguished palæontologist accordingly extends the usual limits of the Tertiary period to include the present time. See GEOLOGY.

QUATERNIONS, the science of vectors, was invented by Sir William Rowan Hamilton, his work being published in 1858. Although it has not led to any new results in mathematics, and although it needs extreme care in handling, because of the complicated nature of its elements, it is certainly a very remarkable branch of mathematical analysis, and gives many elegant demonstrations of geometrical truths in a sort of algebraical fashion, very neat and concise. It is as yet so young that it would be difficult to predict its future. The calculus employed is too abstruse for the present work, and all that can be done is to give a clear idea of the nature of the problems attached; the value of the method, and the meaning of the term "quaternion." The reader who wishes to pursue the interesting subject further is referred either to Sir W. Rowan Hamilton's original work or to Kelland & Tait's "Introduction to Quaternions" (1873), or Tait's "Quaternions."

In ordinary mathematical work we find that to know the line A B thoroughly when the point A is given in position, we need two ordinates to fix the angular distance of the point B, and we need the actual length of the line A B, three elements in all. We cannot estimate the true position of the stars, for instance, because, though we know the two ordinates determining the direction of the line A B, we do not know its length. If we wish to fix the position in space of a mountain-top we must know (1) its longitude, (2) its latitude (these being the two ordinates), and (3) its altitude. It will soon appear, on consideration of a few examples, that every line is fixed in length and direction by three numbers. Let such a line be called a *vector*. Then the problem of quaternions is to determine the relationships of vectors. Since equal and parallel lines will have the same three elements, all such vectors may be regarded as identical. Hence any two vectors may be dealt with as starting from one point. Now, what is required to convert one vector into another? manifestly two things: first,

that it shall be made equal to it in length; secondly, that it shall be turned upon the common point belonging to the two vectors until it has passed through the angular distance at first separating them. The first factor is a simple multiplier defined by one number, and is called the *tensor*; the second factor, the *versor*, manifestly requires three numbers to define it—two for the direction and one for the amount of the turning. Thus, four elements in all are required to define a quaternion. If α and β be two vectors, then their quaternion is represented by $\beta \alpha$; namely, that which when multiplied by α will become β .

$$\text{Thus } \alpha \left(\frac{\beta}{\alpha} \right) = \beta.$$

The addition of vectors is accomplished by regarding them as two sides of a triangle; their sum will then be the third side; or looking at the same thing in another way, the sum of the vectors α and β is the diagonal of the parallelogram of which they are the sides. Vectors are, it is to be observed, symbols of transference; and therefore the sum of two vectors is the representation of the combined effect of the two separate movements which the vectors symbolize.

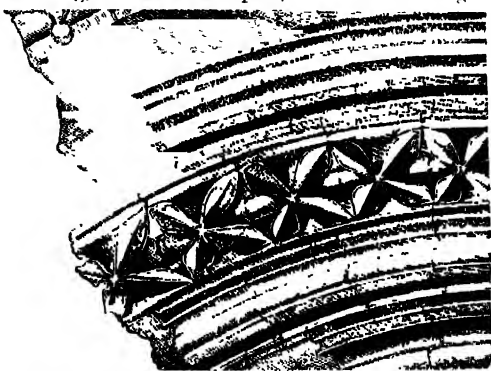
The multiplication of vectors is somewhat more difficult to make clear. Let it be agreed that $-A B$ shall be a line identical with $A B$, but reversed in direction; that is, that the effect of multiplication by -1 is to turn a vector through 180 degrees (two right angles), so that it points due west, for instance, if before turning it pointed due east. Now, since $\sqrt{-1}$ multiplied by $\sqrt{-1} = -1$, it is evident that multiplication by $\sqrt{-1}$ will turn a vector through 90 degrees (a right angle); for if this is done twice the same effect will have been produced as multiplication by -1 , namely, version through 180 degrees. Hamilton imagines three vectors, which he calls i , j , and k , so situated in space that each is at right angles to the two others, and each equal to $\sqrt{-1}$, so that to multiply one by the other is to twist it at right angles and bring it to the position of the third. These three independent vectors may be imagined roughly by supposing a man to stand at the foot of a signal-post whence two lines of railway run, the one east and the other north, then the two lines of rails and the signal-post would all be at right angles to each other. It is evident that every other vector can be readily expressed by comparing it with this system of three, these three representing unit lines along their respective axes.

But a most important peculiarity of quaternions now appears. Suppose the eastward trainway is i , the northward j , and the signal-post k . Multiply j by i , and the result will be (turning left-handed through 90 degrees) to make j coincide with k ($j \times i = k$), the northward railway with the signal-post. But when i is multiplied by j and the same left handed turn through 90 degrees occurs, the eastward railway is twisted into the line of the signal post, but in the opposite direction, namely, downwards, as if it were sunk like the shaft of a coal-mine ($i \times j = -k$). Therefore it is not with quaternions as with ordinary arithmetic and algebra, where any order of the same factors will produce the same product, so that $2 \times 2 \times 4 = 3 \times 4 \times 2 = 4 \times 3 \times 2$, &c., but the order of the factors in quaternions is of material consequence in affecting the result. This will serve to show the complications that beset the subject. At present, from this and other causes, nothing original has been accomplished by means of quaternions, but they evidently form a weapon of immense powers and capabilities, and possibly only await the manipulation of a genius equal or superior to him who invented them.

QUATRAIN, in poetry, a piece consisting of four lines, generally with alternate rhymes, and sometimes intermixed, the first and fourth, second and third, rhyming together, as in the stanzas of Tennyson's "In Memoriam."

QUATRE BRAS, a village of Belgium, in the province of South Brabant, 3 miles S.S.E. of Genappe, and 10 miles from Waterloo. It is situated at the intersection of the roads from Brussels to Charleroi and from Namur to Nivelles (whence its name). On the 16th June, 1815, it was the scene of an indecisive action between the French and the British, with their allies, in which the Duke of Brunswick was killed.

QUATREFOIL, a favourite ornament in architecture, consisting, as its name implies, of a four leaved figure.



Quatrefoil dog-tooth ornament from the Cathedral of Elgin.

Quatrefoils are either voids or solids, either perforations, as in tracery or window-headings, &c., or ornaments on mouldings, as in the very favourite quatrefoil dog-tooth ornament. The points of the quatrefoil are called cusps.

QUATREMÈRE, ETIENNE MARC, an eminent French orientalist, was born at Paris in 1782, of a family engaged in trade. His father, elected a municipal officer of Paris in 1789, was guillotined in 1794. From the wreck of his fortune something was saved, and the young Quatremère was educated with a view to the École Polytechnique. He was early seized, however, by a desire to study the languages and literature of the East, and without any professional object attended the Arabic lectures of the illustrious Silvestre de Sacy. His extensive knowledge of other Oriental languages, living and dead, was for the most part self-acquired. His first work, published in 1808, at once made him famous. In it he proved conclusively that the modern Coptic is the legitimate descendant and representative of the language spoken by the ancient Egyptians, a discovery of the utmost importance to the decipherers of hieroglyphics. After holding other appointments, M. Quatremère was made, in 1819, professor of Hebrew, Chaldee, and Syriac, at the Collège de France; and in 1827, professor of Persian at the École des Langues Orientales Vivantes. His translation of Makrizi's great work practically introduced to Europe the full history of the Mamluk sultans of Egypt. He died at Paris in September, 1857.

QUAT RIBLE, a descant or rather organum moving in fourths with the plain song. See QUINBLE.

QUATTROCENTO, the name of the fifteenth century in art, the "fourteen-hundreds." This was the great pre-Raffaellite period, when Fra Angelico, Masaccio, Mantegna, Botticelli, &c., laid the basis of modern art. Although they are frequently hard and occasionally crude, the quattrocentists are more faithful to their ideals and work more closely to nature than their greater successors of the *cinquecento* (sixteenth century), Leonardo da Vinci, Michelangelo, Raffaele, &c.

QUAVER, in music, a character (♩) thus designated, whose value is half that of a crotchet, or twice that of a semiquaver (♪). The semiquaver is halved as a demi-

semiquaver (♩), and this is halved by a four-hooked note (♩), and so on, each added hook halving the value of the note. Five hooks, the quarter of the quarter of the quaver, is about the limit yet reached.

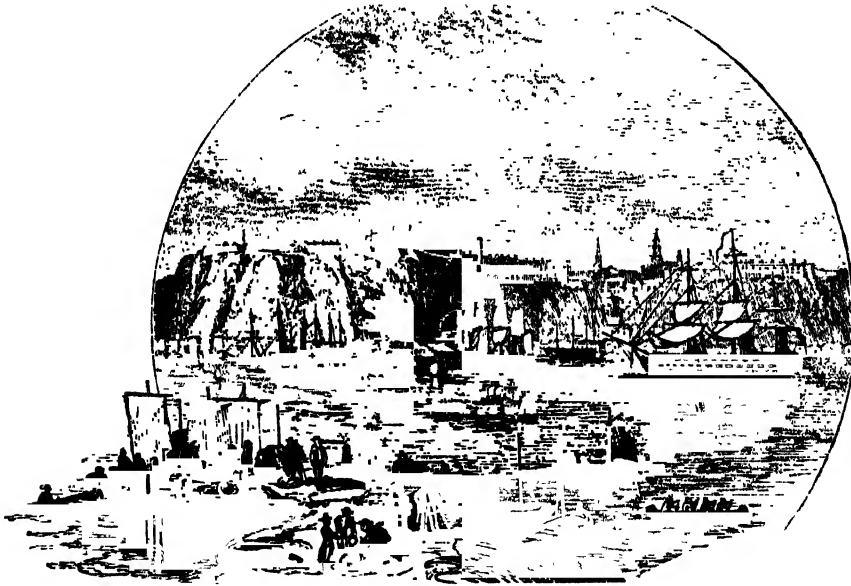
The quaver was invented, to meet the growing requirements for rapidity and variety of note, about the end of the fifteenth century. Gafurius mentions it and figures it (with a diamond-shaped head) in his "Practica Musica" of 1496. Playford was the first to tie a group of quavers or semiquavers, &c., together by a common band (♩) instead of writing them, as we still do minims and crotchets, separately.

QUAY (Fr. *quai*; Dutch, *kaai*), an artificial wharf or landing place, consisting of masonry or a platform on piles, intended to enable ships to load or unload which could not otherwise approach the shore.

QUEBEC, a province of the Dominion of Canada, formerly known as Lower Canada. [See CANADA, DOMINION OF.] It stretches along both sides of the St. Lawrence, from the mouth of the Ottawa River (by which it is for the most part separated from Ontario) to Cape Gaspe, and on the north of the Gulf of St. Lawrence to the Strait of Belle Isle. It also comprises the Isle of Anticosti and the Magdalen Islands, in the Gulf of St.

Lawrence. The winters in this province are very severe, the snowfall being greater than in any province of the Dominion; nevertheless, the soil is fertile and vegetation rapid, so that the cereals, grasses, root crops, and fruits of Western Europe grow freely. Maize or Indian corn also produces large crops. The mineral wealth of Quebec is not so great as that of Ontario, but iron of superior quality is found almost everywhere, and other metals are also found. A large portion of the province is still forest. The fisheries are very important. The majority of the inhabitants being of French origin, mostly descendants of settlers from Normandy established in the province before its transference to the English, they still speak the French language, retain the French customs, and adhere to the Roman Catholic religion. The area of the province is 123,355 square miles, and its population in 1881 was 1,358,469.

QUEBEC, the capital of the province, is said to have been so named by the Indians from a native word *kepeck*, meaning "it is closed," referring to its position on a high promontory overlooking the narrow river passage. The promontory upon which it is situated is formed by the confluence of the river St. Charles with the St. Lawrence, at the north-east extremity of an elevated but narrow tableland, which for about 8 miles forms the left bank of the latter, from the mouth of which it is distant 310 miles. Cape Diamond presents a nearly precipitous face to the



Quebec, from the St. Lawrence.

St. Lawrence; but the descent to the St. Charles is more gradual. The height of the platform of the citadel, which is a massive structure on the summit of Cape Diamond, is 333 feet above the St. Lawrence. Quebec is divided into the Upper and Lower Town. The latter, which is the business quarter, is built round the base of the promontory, where in many places the rock has been removed to make way for the houses. The ascent to the Upper Town is either by a narrow and steep winding street, or by a flight of steps. In addition to the Upper and Lower Town there are several suburbs of growing importance, especially that of St. Roche, on the lower plain. The citadel, which crowns the summit of Cape Diamond, is strongly fortified, and covers about 40 acres of ground. It is the strongest

fortress on the Western Continent, and has been called the "Gibraltar of America." The view which it commands is one of the most extensive in the world. A wall, mounted with heavy ordnance, surrounds the Upper Town, which is entered from the citadel by five gates, strongly defended, and near one of them is the hospital and guard-house. The St. Louis Gate, on the south-west, leads to the PLAINS OF ABRAHAM, the scene of Wolfe's victory and death in 1759, the exact spot of which is marked by a column. There are both a Protestant and a Roman Catholic bishop of Quebec. The Protestant cathedral is a plain modern edifice with a spire. The other chief buildings are the Laval University, the parliamentary and government buildings, the court-house, the Catholic cathedral, the convent

and church of St. Ursula, the exchange, government warehouses, and the Hospital Hotel-Dieu. In addition to several Roman Catholic and Church of England churches, there are Presbyterian, Methodist, Baptist, Lutheran, Congregational, Scandinavian, French Protestant, and Jewish places of worship, and several educational, literary, and benevolent institutions. Most of the public buildings are substantial rather than elegant. In the public garden of the citadel is an obelisk in memory of Wolfe and Montcalm; and the promenade above the esplanade affords extensive views. The Mount Hermon Cemetery, above the St. Lawrence, 3 miles from the city, covers 32 acres. The most attractive object in the vicinity is the Fall of Montmorenci, 8 miles distant; the river at this point is 60 feet wide, and the descent of the torrent 250 feet. The winter lasts from November to May; during December, January, and February, the thermometer usually ranges from freezing-point to some degrees below zero. Occasionally the river is entirely frozen over, so as to stop all navigation. During summer the range of the thermometer is from 60 to 90 degrees, and the average is about 68 degrees. The population in 1759 was 8000 or 9000; 20,000 in 1825; 36,000 in 1843; and in 1881 it had increased to 62,116.

The harbour of Quebec, between the city and the island of Orleans, is accessible to the largest vessels, which can lie close to many of the wharfs. This port is the great depot for the trade of Canada with Great Britain, the West Indies, &c., and considerable numbers of emigrants from the United Kingdom to all parts of British America land here every year. The shortest sea route to Liverpool is 2631 nautical miles. Lines of railways or steam packets connect Quebec with all the principal towns of Canada, with New York, Portland, Boston, Chicago, &c., in the United States, and with Halifax in Nova Scotia. The chief exports are timber. The industrial establishments of the city comprise distilleries, breweries, soap, candle, and tobacco factories, &c.

The city was founded by Samuel de Champlain, the French geographer and navigator, in 1608, on the site of the Indian village of Stadacona, at the confluence of the St. Lawrence and St. Charles rivers, which Jacques Cartier is said to have first visited in 1535. It was taken by the British in 1759, and was besieged by the Americans in 1775-76. On several occasions it has suffered severely from fire.

QUEEN, the Saxon *Queen*, a woman (Gr. *gune*, Sansk. *juni*), was used to denote *mulier*, *femina*, *conjug*, as well as women of the highest rank. The use of it as the title of a princess who reigns in her own right, and possesses all the powers which belong to a male person who has succeeded to the kingly power in a state, is a modern application of the term.

Queen Consort.—In England the king's wife has some peculiar legal rights. She can purchase lands and take grants from the king her husband; she has separate courts and officers, including an attorney-general and a solicitor-general; she may sue and be sued apart from her husband, have separate goods, and dispose of them by will. She pays no toll, is not subject to imurement, and has a share in fines made to the king for certain privileges, which last is called *queen's gold*. Originally "queen's gold" included a gold mark for every hundred silver marks paid to the king, and this is the *gersumma regine* spoken of in Domesday Book. The last claim out of it was Henrietta Maria, queen of Charles I., and she surrendered it for a grant of money, 1635. Anciently manors belonging to the crown were assigned to her in dower, but now the provision for her is made by a parliamentary grant. It is treason to compass or imagine the death of the king's wife. To violate or defile her person is also treason, though she consent. It has been the usual practice to crown the

queen with the same kind of solemnities as are used at the coronation of a king.

If a queen dowager marry a commoner she does not lose her rank; but no one can marry a queen dowager without special license from the sovereign.

A *queen regnant*, or princess who has inherited the sovereign power, differs in no respect from a king as to the political rights vested in the dignity. This was absolutely settled by a statute of Mary, the first queen regnant of England, passed April, 1551. See KING.

QUEEN ANNE'S BOUNTY. See BOUNTY, QUEEN ANNE'S.

QUEEN'S COLLEGE, OXFORD. Queen's College, High Street, was founded in 1310 by Robert de Eglesfield, chaplain to Queen Philippa. The present buildings are comparatively modern, being the work of Wren and Hawksmoor, and dating from 1714. The buildings are plain, and of no particular interest. The chapel is chiefly remarkable for its windows and marble pillars. The hall, like all Christopher Wren's rooms, is of fine proportions, and has a lofty arched roof. The procession of the Boar's Head is an annual custom at Queen's on Christmas Day, and is carried out with much pomp and antique ceremony. There is another odd custom on New-Year's Day, when the bursar presents to each guest a needle and thread, with the words: "Take this and be thrifty." The library, which is close to the hall, was first started in 1691, and is now the largest and most valuable collegiate library of printed books. Among the curiosities of Queen's is the ancient drinking horn presented by Queen Philippa.

Its celebrities include Henry V. and the Black Prince, Cardinal Beaufort, and John Wicliff, the translator of the Bible. Addition was also for a short time at Queen's College. There are twenty open Foundation-Scholarships, of the inclusive annual value of £80, one of which is awarded every year for mathematics, and one for natural science. Five Eglesfield Scholarships, of a like value, are open to natives of Cumberland and Westmorland, the limit of age for both Foundation and Eglesfield Scholarships being nineteen years. The Jodrell Scholarship, in classics and divinity, of the annual value of £90, and tenable for four years, is awarded every fourth year, being open to persons under twenty years of age; the candidate who most requires assistance has the preference. Two Bible clerkships, worth £80 a year each with free lodgings, are in the gift of the provost. The twenty-five Hastings Exhibitions, of the value of £90 per annum each, are open without restriction of age to candidates from certain schools in Cumberland, Westmorland, and Yorkshire. There are also numerous minor exhibitions, and also five others of importance, which, although tenable at the college, are not awarded by it. The fellowships number from fourteen to sixteen, and are divided into ordinary and official. The official fellowships are held by tutors, lecturers, or bursars, and are tenable for fifteen years, with reappointments of not more than seven years each. Official fellows receive, in addition to the stipend of ordinary fellows, £100 a year out of the corporate revenue, and a varying amount from the tuition fund. The three senior official fellows and the senior bursar are permitted to marry.

QUEEN'S COLLEGE, CAMBRIDGE. Margaret of Anjou, wife of Henry VI., humbly petitioned her lord and master for leave to imitate his munificence, that, as he founded King's College, she might found a Queen's College in honour of St. Margaret and St. Bernard. Andrew Doket, principal of St. Bernard's Hostel, had already, in 1446, obtained two charters from the king to turn his hostel into a college, but the queen obtained a third charter in 1448, and endowed the college out of her own pin-money. Doket was appointed by Margaret the first president, and, being a prudent man, managed to be on equally good terms with Elizabeth Woodville, queen of Edward IV.

She added to the endowments and gave fresh statutes to the college, and is always regarded as a co-foundress. The proper name is thus *Queen's*, and not *Queen's Col lege*. The buildings, standing in a retired street and overhanging the river, are, as a whole, some of the most interesting in Cambridge. There are four courts, of which the principal one is entered under a massive tower gateway of brickwork, having four hexagonal turrets at the corners, of a kind frequently seen in Cambridge, but unknown at the sister university. The outside of this court is also finished with short square towers at the four corners. In the stone vaulting of the gateway may be seen the patron saints, Bernard and Margaret, respectively kneeling and trampling on a grovelling dragon.

The chapel, built in the reign of Henry VI., and disfigured by improvements in 1773, was carefully re-tored and richly decorated in 1861 by Mr. Bodley. The hall was restored, and its old roof uncovered at the same time and under the same direction as the chapel. South of it is the small Pump Court, or Erasmus Court, in which Erasmus is supposed to have lived when he visited Cambridge at the invitation of Fisher, President of Queen's and Bishop of Rochester, to teach the newly-introduced study of Greek. The worthies of this college include Fisher, Erasmus, Milner, and King; to these may be added John Smith, author of "Select Discourses in Divinity;" Thomas Fuller, the antiquary; Sir Samuel Egerton Brydges, the commentator; and Dr. Samuel Lee, successively professor of Arabic and Hebrew, and an eminent linguist. The Foundation Scholarships, tenable to the end of ninth term of residence, are awarded by the results of the various college examinations held in the Easter Term. The president has at his disposal funds to the amount of £130 per annum, with which he assists deserving students of limited means. There are thirteen Foundation Fellowships, one of which must be reserved for a university professor. The Fellowships are tenable for seven years from the day of election, unless the fellow be instituted to a college living worth more than £400. Each fellow receives an annual dividend not exceeding £200, besides 10s. a week and his commons in hall during residence.

QUEEN'S COLLEGES, IRELAND, were instituted by the government of Sir Robert Peel in 1845, in order to afford high class education to students of all religious denominations. To do this it was of course necessary to confine the teaching to purely secular matters; hence the Roman Catholics often styled them "Godless Colleges." They were established at Belfast, Cork, and Galway, and in connection with them was the Queen's University at Dublin, founded on similar principles in 1850. By the 42 & 43 Vict. c. 65, passed in 1879, the Queen's University was dissolved, and a new Irish University established in its place. See **IRELAND**.

QUEEN'S COUNSEL, barristers selected from the ordinary bar in the name of her Majesty, and thereby entitled to wear a silk gown, to sit within the bar, and to take pre-attendance of their unselected competitors. The lord chancellor nominates the barristers, and the crown appoints them. A queen's counsel can never take a brief under an ordinary barrister, but may do so under another queen's counsel of superior standing. Queen's counsel receive no salary, nor have they any duties towards the crown. If, however, they desire to plead against the crown, as in criminal cases, &c., leave must be obtained and a small fee paid. Leave is never refused. The practice of appointing queen's counsel dates from 1590, when Elizabeth advanced Sir Francis Bacon to this dignity.

QUEEN'S COUNTY, a county of the province of Leinster in Ireland, is bounded N.W. and N. by King's County, E. by Kildare, S. by Kilkenny, and S.W. by Tipperary. Its greatest length, E. by S. to W. by N., is 37 miles; its greatest breadth, at right angles to the length,

is 33 miles. The area is 663 square miles, or 424,854 acres. The population in 1881 was 73,124. In 1841 the population was 153,988, so that the number of inhabitants had decreased more than one-half in the forty years.

Surface, Geological Character, and Hydrography.—Two principal groups of hills traverse the county. The Slieve Blooms, or Bloom Mountains, occupy the north-western part, and in one place separate Queen's from King's County; the highest point, called Arderin, is 1734 feet above the sea. The Dysart Hills traverse the south-east, and divide the valley of the Barrow from that of its tributary the Nore. They are situated in the best wooded part of the county, and do not form a continuous ridge, but consist chiefly of isolated hills. The rest of the surface is flat, or varied only by gentle undulations.

The greater portion of the shire is included in the limestone district, which overspreads so large a part of Ireland. The Slieve Blooms are composed chiefly of sandstone, and a portion of the Dysart Hills is formed by the anthracite coal measures. This large coal-field extends from this county into Kilkenny. The other minerals are iron, copper, and manganese. Fuller's earth and mail are procured; marble is quarried in a few places, and limestone almost everywhere.

The principal rivers are the **BARROW** and the **Nore**. The latter is a tributary of the former, but does not join it till long after it has quitted this county; it rises in Tipperary, enters Queen's County on the south-west, and flows north-east and east to Castletown. Below Castletown it turns to the south-east, and before finally quitting this county separates it for a short distance from Kilkenny. It receives the **Tomnet** and several other small tributaries on the left bank. The **Lower or Little Brosna**, or **Brunna**, which joins the Shannon below Banagher, rises just within the western boundary of the county; and the **Clodagh**, whose waters fall into the Brosna, which also joins the Shannon above Banagher, rises within the northern boundary.

The only lake is **Lough Annagh**, on the northern boundary; it does not exceed a mile in length. Bogs are numerous in the centre, between the Slieve Blooms and the Dysart Hills.

A portion of the Grand Canal enters the county at its north-eastern corner, and there divides into two branches, one of which runs westward about 12 miles to Mountmellick; the other, known as the **Athy Canal**, runs 12 miles southward to Athy, just below which town it joins the Barrow. The Great Southern and Western Railway crosses Queen's County from north-east to south-west.

Soil and Agriculture.—The land is generally fertile, but almost every kind of soil is found, from a very stiff clay to a light sandy, though fertile, loam. There are extensive tracts of bog, and a good deal of cold wet ground, especially near the mountains, but much land has been recovered by draining. The occupations of the inhabitants are almost exclusively agricultural; tillage is much practised, green crops are cultivated, and dairies are numerous.

Divisions and Towns.—Queen's County is divided into eleven baronies, and contains fifty-three parishes, mostly in the united diocese of Ossory, Ferns, and Leighlin. It is in the Home Circuit, and the assizes are held at Maryborough, the county town. The county returns two members to the House of Commons.

History.—Of the inhabitants of this district, in the earliest age of Irish history, nothing certain is known. At a later period the county was comprehended in the districts of Leix and Ossory, which appear to have maintained a state of precarious independence from the reign of Edward II. to that of Henry VIII. On the death of the last-named monarch, the O'Mores, who held the district of Leix, having rebelled in conjunction with the O'Connors of Offaly (now King's County), were defeated by Sir Edward Bell-

ingham, the lord-deputy, who sent their chiefs prisoners to London (where O'More died), and reannexed their territories to the English pale. Queen's County was the scene of some severe contests during the rebellion which commenced in 1641, and again in the war which followed the revolution of 1688.

QUEEN'S EVIDENCE. When one of a number who are apprehended for a crime committed by them collectively confesses his guilt, and is permitted to give evidence as a witness against his accomplices, he is called "queen's evidence." Such a person generally receives a pardon, though he is not absolutely entitled to it. See *APPROVER*.

QUEEN'S METAL is an alloy intermediate in hardness between pewter and Britannia metal, used for teapots, spoons, &c. It is made by fusing under charcoal 9 parts of tin, with 1 each of antimony, bismuth, and lead; or tin 100 parts, to antimony 8 parts, copper 4, and bismuth 1.

QUEEN'S FERRY, SOUTH, a burgh in the county of Linlithgow, on the south bank of the Firth of Forth, about 9 miles north-west of Edinburgh. It is celebrated for its beautiful surrounding scenery and as a bathing-place. It is one of the Stirling district parliamentary burghs. The place is said to have received its name from Eleanor, queen of Malcolm III., who used it as a place of embarkation. The population of the burgh in 1881 was 1676.

QUEEN'S LAND, the youngest of the Australian colonies, comprises the north-eastern portion of the continent. It extends north of New South Wales to the Gulf of Carpentaria and Torres Strait, having the Pacific on the east, and on the west the hundred and forty-first meridian of longitude, from the twenty-ninth to the twenty-sixth parallel, and thence the hundred and thirty-eighth meridian to the Gulf of Carpentaria, forming the boundary between it and South Australia. In length it extends about 1400 miles, in breadth about 1000 miles; its area is 669,520 square miles, or nearly twelve times that of England and Wales, and as large as Great Britain, France, Germany, and Italy combined. The coast-line, of more than 2500 miles, has many fine harbours. The population, 30,059 in 1861, had increased to over 320,000 in 1886, chiefly due, of course, to immigration, for which the healthy climate, though the northern part is within the tropics, and the richness and variety of its natural products render it peculiarly suitable. It is doubtful if Europeans can labour safely under the sun in the lower parts of the northern region, but the heat of the tropics is mitigated by the south-east trade winds and the summer north-west monsoons, so that it is not nearly as great as might be expected from the latitude. The western regions are dry, but they escape the dreadful Australian "hot winds," and their aridity will be much mitigated by storage of water and artesian wells as they become more settled. In the south, on the Darling and Peak Downs, the air is cool, and European fruits flourish. Everywhere winter in the English sense is unknown. Numerous bays and gulfs indent the Pacific coast, along a great part of which the great Barrier Reef of the Coral Sea extends, at an average distance of 50 miles from the land, forming a huge natural breakwater. Besides Moreton Bay, the principal harbour of the colony, there are good ports at Harvey Bay, Keppel Bay, Port Curtis, Port Bowen, Port Denison, Rockingham Bay, Port Albany (near Cape York, the north extremity), and at Investigator Road, at the head of the Gulf of Carpentaria. Very numerous islands stud the coast, the largest being, from south to north, Stradbroke, Moreton, Bribie, Frazer or Great Sandy Island, Curtis, Whitsunday, Palm, Hinchinbrooke, and Lizard; Prince of Wales, in Torres Strait; and Wellesley Islands, in the Gulf of Carpentaria. A range of mountains, called generally the Coast Range, but comprising many divisions with separate names,

extends along the Pacific sea-board, at an average distance of 50 miles from it, from south to north, through the colony. Few points of it exceed 3000 feet above the sea; the Bellenden Ker peaks, towards the north of the range, attain 5400 feet. This range divides the colony in the direction of its length into a narrow coast-strip, watered by streams discharging into the Pacific, and a long interior slope, which is divided by the M'Kinlay range, running westward at right angles to the great north and south range, into a region watered by rivers discharging into the Gulf of Carpentaria, and into another the rivers of which lose themselves in the lakes or marshes of South Australia, or, like the Condamine and the Barwon, rise in the main chain and join the Darling in its course to the Murray and the ocean at Spencer's Gulf. Taking a general view, the main mountain range is the great field of mineral wealth and agricultural land; the long coast strip, with a hot moist climate, is suited for the growth of sugar, cotton, indigo, and maize; the interior region south of the M'Kinlay is the seat of the great pastoral plains, chiefly adapted for horses and cattle, sheep flourishing most on the downs and higher plateaus; and the region north of the M'Kinlays—embracing the mineral Cloncurry highlands, with their rich copper mines, the fertile districts of the Flinders and the Leichhardt rivers, a sandy unavailable district on the slope of the main range, and the rich lands of Cape York Peninsula, in the extreme north, where the flats are favourable to sugar and rice, and the slopes to the increasing cultivation of the coffee tree—offers great variety to the settler.

Traces of volcanic action are found almost everywhere, and to its effects the soil owes much of its fertility. Geologically, the country is broadly divided into two portions—the west interior of desert sandstone, and the eastern and northern maritime borders of primary and secondary rocks, in which coal, gold, granite, slate, and basalt are found, though these are almost absent in the former. Up to the present time gold, coal, copper, and tin are the metals chiefly worked; but iron and other metals abound, and will no doubt be opened up as the colony develops. In 1858 the discovery of paying gold-fields was made, and since that time upwards of twenty gold-fields have been made known. The gold is not as pure as that of Victoria, and is now chiefly worked from the quartz, which at Gympie and Maryborough has yielded fine results. The alluvial diggings of the Paliver, in the extreme north, are mostly worked by Chinese. The whole range appears to be auriferous, but the most important of the reefs at the present time are those of the Palmer and Mitchell river districts and of the Hodgkinson field, discovered in 1876, in the north, between 16° and 17° S. lat., reached by the ports of Cooktown, Cairns, and White Island Point. The quantity raised up to the end of 1884 amounted to 4,529,280 ounces, which, at £3 10s. per oz. = £15,852,480. Mount Morgan, south of Rockhampton, is the richest working yet opened. Silver is worked in the region of Charters Towers, copper is found in surprising richness in the Cloncurry highlands, and is widely spread over the colony, as are most of the other metals, including great deposits of iron. Tin occurs in streams and in lodes, and is worked in the Tinaroo district, sometimes called the Cornwall of Australia for its mineral wealth. The coal-fields are of vast extent, and it has been thought that the whole of the western plains have coal underlying them. The quality is in general good, and suitable for steam and gas purposes. Pits have been opened near Brisbane, Ipswich, Darling Downs, Maryborough, and Bundaberg. In 1884 129,980 tons were raised.

Pastoral farming is at present the favourite occupation, and vacant lands are being rapidly taken up. Sheep flourish best on the downs and higher plateaus, horses and cattle in the hills and moister regions. They need, especially in the north, no food except the native grasses. Agricultural

farming is not so popular, and while it is doubtful whether European crops can be profitably grown in the tropical north, the question of labour must seriously interfere with successful competition against tropical productions in older and more populous countries. Cotton, coffee, tobacco, and arrow root are grown, and it is hoped that silk cultivation may follow the successful introduction of the mulberry tree. Owing to insect pests, grapes and oranges have hitherto failed. The sugar-cane, however, is now most widely grown; it flourishes along the whole length of the Pacific coast. The leading grain crop is maize, but wheat and European fruits flourish on Darling Downs. The chief features of the provisions under which settlers may acquire land, are—the land for purchase is divided into three classes: agricultural land, which may be bought in lots of from 40 to 640 acres; first-class pastoral land, divided into lots of from 80 to 2560 acres; and second-class pastoral land, in lots of from 80 to 5620 acres. The prices in the three classes are from 15s., 10s., and 5s. respectively. The purchaser, after selecting his lot, pays one-tenth of the sum in advance. He is then bound to fulfil certain conditions, including residence, and the expenditure of a certain sum (in the case of agricultural land 10s. an acre) in the improvement of the land, besides providing substantial fences. If at the end of three years he has satisfied these conditions he has a right to the property, so soon as he has paid the balance of the purchase-money—the whole sum having to be paid in ten annual instalments. As regards leases, under a Land Act passed in 1884, a maximum of 1280 acres of agricultural land can be selected for fifty years, and a maximum of 20,000 acres of pastoral land for thirty years. Besides this, there is a homestead law initiated from that of the United States.

About one-half the area of the colony is under forest. Among indigenous woods are cedar, red, white, and blue gum, iron and stringy bark, Moreton Bay pine, acacia, box, tulip, and sandal. The fern tribe is represented by upwards of sixty species. The animals of Queensland comprise several varieties of kangaroo and opossum, bandicoots, wombats, dingoes, flying foxes, &c.; among birds, the eagle, great king-fisher, pigeon, parrot, cockatoo, quail, duck, emu, bustard, crane, heron, and black swan. Snakes are plentiful (over sixty species, five being poisonous). Alligators are numerous in the northern rivers; the whale, seal, dugong, shark, and turtle appear in the seas. There is an important pearl fishery on Torres Straits.

The rivers discharging into the Pacific have short courses, and are generally obstructed by bars. The most important going north are the Brisbane, navigable up to the capital, 20 miles from its mouth, the Burnett, Fitzroy, and Burdekin; those discharging into the Gulf of Carpentaria are the Mitchell, Gilbert, Flinders, and Albert; of those flowing south and south-west, and lost in the desert or salt lakes, the most important are the Barcoo and Thomson. Owing to the fine harbours and the great distances between the sea-board towns, there is great rivalry among them for independent and special advantages in trade and communication.

BRISBANE, in the south, is the capital and chief seat of trade; Cooktown in the extreme north ranks next. Rockhampton, up the Fitzroy, is the outlet for an important pastoral and mining district. Townsville, on Cleveland Bay, Ipswich, south of Brisbane, a farming centre, and Gladstone, south of Rockhampton, are other important towns.

Naturally, in a colony with an interior of such fertility and wealth, there is a tendency to enter on vast schemes of railway construction, of the speedy monetary success of which there cannot fail to be doubts. One such scheme is to connect the Gulf of Carpentaria with the eastern coast, at a cost of £10,000,000. At the end of 1885 there were 1300 miles of railway open, and 700 in construc-

tion or authorized. At the same time about £12,000,000 of the public debt was due to outlay on railways, which yielded in revenue £680,631 against £357,535 expenditure. The western line connects Brisbane with the Darling Downs. The south-western is extending in the direction of Cammulla. From Rockhampton the line is extending towards the Barcoo Downs, while the Flinders river district is to be connected with Townsville, further north.

The form of government of the colony of Queensland was established in 1859, on its separation from New South Wales. The power of making laws and imposing taxes is vested in a Parliament of two houses—the Legislative Council and the Legislative Assembly. The former consists of thirty-six members, nominated by the crown for life. The Legislative Assembly comprises fifty-five members, returned from forty-two electoral districts, for five years, elected by ballot, a six months' residence qualifying every adult male for the franchise. Owners of freehold estate, of the clear value of £100, or of house property of £10 annual value, or leasehold of £10 annual rent, or holders of pastoral lease or license from the crown, have the right of a vote in any district in which such property may be situated. The executive is vested in a governor appointed by the crown, who is commander-in-chief of the troops, and also bears the title of vice-admiral. He has a salary of £5000 per annum. In the exercise of the executive authority he is assisted by an executive council of seven ministers. There is a force of more than 1200 officers and men; and two gunboats and one small torpedo-boat are for the defence of the colony. There is no state church. Previous to 1861 valuable grants of land had been made to the principal religious denominations, which they still retain, free of taxation. The following are the proportions the various religious denominations bore to the total population at the last census, taken in 1881:—Church of England, 31·62; Church of Rome, 25·47; Presbyterians, 10·59; other Protestant churches, 19·48; other religions, 9·07. Education is compulsory, but no steps have been taken to enforce the law. The revenue for 1885-86 was estimated at £2,982,500, of which customs yield nearly £1,000,000, land and rents about £500,000. The expenditure was estimated at £3,006,214, which included interest on debt, £732,000. This amounted in 1886 to over £19,000,000. The value of the property of the colony in 1886 was approximately £32,000,000. The staple article of export from Queensland to the United Kingdom is wool, the value of which was £839,130 in 1880, and £1,600,000 in 1885. The only other notable articles of export to Great Britain are preserved meat, of the value of £20,000, and tallow £26,000. The chief imports of British produce into Queensland are apparel and haberdashery; iron, wrought and unwrought; cottons and woollens. The total trade between the two countries in recent years was as follows:—

	Imports into the United Kingdom.	Exports to Queensland.
1883, . .	1,540,013	2,429,203
1884, . .	1,682,442	2,075,065
1885, . .	1,894,899	2,447,000

The census of 1881 gave the population as 213,525—125,325 males, 88,200 females. The number included 11,229 Chinese, of whom only 23 were females, principally engaged in the gold mines; and 6348 Polynesians, 597 of whom are males. No return is made of the aborigines, but police reports estimate their number at 20,585—10,719 males, and 9866 females. The estimated population in 1885 was 318,606.

History.—Queensland was formerly known as the Moreton Bay district of New South Wales, that name having been given to it by its discoverer, Cook, in May, 1770. Flinders examined the coast more minutely in 1797 and in

1801. In 1817 Lieutenant King chartered the shores, and in 1825 the first batch of convicts were settled near the site of Brisbane. In 1837 the first steamer anchored in Moreton Bay, and in 1839 convict immigration was stopped. The interior was first partially explored by Mr. Oxley and Sir J. Mitchell, and between 1848-46 by Dr. Leichhardt. In 1856 its population had reached 17,082; and in December, 1859, the Moreton Bay district was erected into a separate colony, under the name of Queensland, and its first Parliament met in May, 1860.

QUEENS'TOWN, called the Cove of Cork, from which it is 13 miles E.S.E., until the visit of Queen Victoria in 1849, when it was named Queenstown, is a market-town, seaport, and an important naval station of Ireland, in the East Riding of the county of Cork. It is situated on the south side of the Great Island, which rises from the water's edge to a height of 305 feet. The streets rise in successive tiers, and present a very picturesque appearance from the harbour and opposite shores. There are places of worship for Roman Catholics, Episcopalians, Presbyterians, and Methodists, including a splendid Roman Catholic cathedral. The houses are generally well built, and are faced with slate to protect them from the prevailing storms. Queenstown, though of considerable extent, carries on little trade; but from its salubrity it is a favourite resort for invalids. The population in 1881 was 9755.

QUENTIN, ST., an important manufacturing town of France, in the department of Aisne, 80 miles north-east of Paris, situated on the Somme and the Canal of St. Quentin, which connects the Somme and the Scheldt. Its chief buildings are the town-hall and the churches, one of which dates back to the thirteenth century. It is a great centre of cotton spinning and the weaving of muslin curtains and imitation lace. The population in 1881 was 45,838. St. Quentin was the ancient capital of the Vermandois, the *Augusta Viromandunorum* of the Romans. It was the scene of a great battle in 1557, between the French and the Spaniards, in which the former were defeated, and also in 1871 of a victory of the Germans over the French, under General Faidherbe.

QUER' CIA, JACOPO DELLA, one of the earliest of the great Italian sculptors of the Revival, was born near Siena about 1374. Till towards the close of his life Della Quercia worked chiefly in Lucca, Bologna, and Florence. He studied more directly from nature than his predecessors, and he was one of the first among modern sculptors who was really successful in rilievo. In Lucca he executed a mausoleum for the wife of Paolo Guinigi, in the Church of San Martino, which was greatly admired, and of which some of the rilievo are now in the gallery of Florence; also, a magnificent marble altar for the Church of S. Friano. At Bologna his principal work was the great doorway of the Church of S. Petronio. On this, which was in marble, and decorated with rilievo from the Old Testament, statues of the Virgin and Child, S. Petronio, &c., Della Quercia was engaged for twelve years, and it was thought to surpass any previous work of the kind. On its completion he went to Florence, where he carved the "Assumption of the Virgin" above the doorway of Santa Maria del Fiore. Returning to his native place he was employed to erect the great fountain on the piazza of Siena, a magnificent work, in the centre of which he placed a figure of the Virgin surrounded by the cardinal virtues, and on the base rilievo of subjects from the Scriptures. This fine piece of sculpture served for centuries all the rough usage of the chief water supply of the city, till at last it ran a fair chance of being utterly ruined. It was then taken to pieces and carefully removed to the Cathedral Museum, and a facsimile in marble erected in its place. Thenceforward the artist lived in honour in Siena, designated by his fellow-citizens Jacopo della Fonte, in testi-

mony of the great work with which he had adorned the city. He died at Siena in or about 1438.

QUER'CITE or **QUER'CIN**, a sugar obtained from acorns. It forms hard white crystals, having the formula $C_6H_{12}O_5$. It is soluble in water. Nitric acid converts it into oxalic acid. It melts at 235°C (455°Fahr.), and forms a definite compound with baryta.

QUER'CITRIN, a neutral substance obtained from quercitron bark, *Quercus tinctoria*, natural order Corylaceae. It crystallizes in small rectangular tablets, slightly soluble in cold water, more soluble in boiling water and in alcohol. The formula is $C_{33}H_{30}O_{17}$. It is a glucoside, and is converted by boiling with dilute mineral acids into glucose and quercetin ($C_{23}H_{16}O_{10}$). This substance is obtained as a lemon yellow crystalline powder, insoluble in cold, and only slightly soluble in boiling water. It is very soluble in alcohol. When treated with potash it produces quercetic acid ($C_{17}H_{12}O_8$). This substance crystallizes in silky needles, soluble in hot water, alcohol, and ether. It forms a bright blue solution with ferric chloride even when very dilute. A dilute aqueous solution exposed to the air assumes a deep carmine colour. The acid dissolves with a red colour in oil of vitriol, and is precipitated in red flocks by water. It forms purple solutions with alkalis.

QUER-FLOTE or **QUER-PFEIFE**. The syllable *quer* is the German for athwart. *Quer-flöte* is therefore only the German for *flauto traverso* (Ital.), the usual concert flute. *Quer-pfeife* is the Swiss fife, with six holes and no keys, giving an incomplete compass of two octaves.

QUERN or **KERN** (the Old English *cweorn*, that which grinds, connected with the Greek *guris*, meal, and coming from the Aryan root $\sqrt{\text{GAR}}$, to grind), a handmill for grinding corn, the use of which is of great antiquity. It is even yet to be found in use in one or two of the most remote spots of Ireland and the Hebrides, and occurs as a relic of prehistoric or early times all over these islands and continental Europe. The usual form is that of two circular stones, the lower one carrying a pin which protrudes through a conical hole in the upper one, and forms a pivot, the grain being dropped into this hole, all round the pivot.

QUES'AL (*Pharomacrus mocino*) is a species of TROGON (Trogonidae). The quescal is a very rare and beautiful bird, found at high elevations in Guatemala. Its most striking feature is the long tail of the male bird, the longest feathers of which measure over 3 feet; the middle tail-feathers are black, the outer white with black bases. The male bird is about the size of a turtle dove, its upper parts, throat, and foreneck glowing with a brilliant golden-green colour. Some beautiful drooping plumes of the same colour spring from the shoulders and hang over the wings. The breast is bright scarlet. The head is adorned with a thick, rounded crest, and the bill is yellow. The female is smaller, with a black bill and less scarlet on the breast; and she is devoid of the long tail and the plumes of her mate. The food of the quescal consists chiefly of fruits. It has various cries, which the hunters imitate to bring the bird within reach of the gun. Its flight is rapid and straight. Several other species occur in South America, but none equal the quescal in beauty.

QUETTA, a fortified town in the Khelat State, Baluchistan. It is situated at the northern end of the valley of the same name, on the direct route from Jacobabad and Shikarpur to Kandahar, via the Bolan Pass, being at the same time very conveniently placed as regards Khelat (Kalat), from which it is distant 103 miles north, and other Baluch towns. In summer the climate is considered very pleasant, the heat being tempered by cool breezes from the lofty hills which on all sides surround the valley. Numerous gardens and orchards abound in the suburbs, and the water supply is good. Quetta has been the seat, since 1876, of a British political officer, with an adequate military escort, under the official designation of the

governor-general's agent for Baluchistan. During the Afghan campaign of 1878-80 Quetta formed the base of operations of the southern column. The British troops advanced from Quetta to Kandahar, which they occupied with practically no resistance. A railway to Quetta was afterwards constructed. It starts from the Sind Railway system at Sukkur, and runs via Jacobabad through the Bolan Pass. An alternative route, via Dhera Ghizee Khan and Thall Chotialé, has been surveyed.

QUEVEDO Y VILLEGAS, FRANCISCO GOMEZ DE, an eminent Spanish satirist, was born at Madrid, September, 1580. On leaving the university of Alcalá an affair of honour caused him to flee from Spain to Spanish Italy. At Naples he executed some important commissions for the ambitious Don Pedro Giron, duke of Osuna. After the fall of his patron Quevedo was arrested and imprisoned for nearly four years (1620-24) without any accusation. He was undoubtedly one of the best writers of his age, both in prose and verse; and, with the exception of Cervantes, no Spanish author has ever displayed more originality. His "Sueños" or Visions enjoyed the greatest celebrity. In 1641 he was again imprisoned for writing satirical verses. His property was confiscated, his health broke, and he subsisted almost on charity till his death, in 1647, from maladies contracted in prison.

QUI TAM. In those statutes by which certain acts are prohibited under a penalty, it is usual to encourage the enforcing of the penalty by appointing the whole or some part of it to be paid to the person who shall take the risk and trouble, and incur the odium, of bringing the matter before a court of law. When the part of the penalty not given to the informer is directed to be paid over to the poor of the parish, or to be applied for other purposes, the informer may, if he think fit, sue in his own name only; but where a part, commonly a moiety, is given to the crown, the proceeding is in the following form:—"A. B., who, as well (*qui tam*) for our lady the queen as for himself, in this behalf prosecutes, complains," &c.

When a *qui tam* or other penal action is commenced no other person can afterwards sue the defendant in respect of the same offence, whatever the result of the first action may be. It is therefore not unusual for offenders against penal statutes to protect themselves by procuring one of their friends to sue. This, however, will be of no avail against a subsequent informer suing *bona fide*, provided the fraud and collusion in the first action can be shown. In Scotland, where penal prosecutions are generally instituted by the procurator-fiscal, there are few instances of complaints by common informers, and the term used for such in the English law is unknown.

QUIA EMPTOR ES, a famous statute of English law, passed in 1290, and the germs of which are to be traced in Henry III.'s Charter of the Forest of 1217. It has the peculiarity of having been passed by the Peers while waiting for the arrival of the Commons at Westminster. This statute forbade *subinfeudation*, and enacted in any case of alienation that the land was to be held not of the letting tenant, but of the superior lord. The effect was at once to increase the class of small freeholders holding direct from the crown or the great lords.

QUICK SILVER. See MERCURY.

QUIDDITY (*Quidditas*), an old schoolman-phrase, meaning the essence of a thing. To the question *Quid est?* (What is it?) the answer would be, "The *quid* is so and so" (*Talis est quidditas*).

"Where entity and quiddity
(The ghosts of defunct bodies) fly."
—*Hudibras*, l. 1.

QUIETISM is the name of the doctrine of certain ascetic Christians who taught that the chief duty of man was to be wrapt up in the continual contemplation and love of God, so as to become totally independent of out-

ward circumstances and of the influence of the senses. There have been men so disposed in all ages of Christianity, without forming a sect, and even the Mohammedans and Brahmins have their Quietists; but it was a Spanish priest called Michael Molinos, in the seventeenth century, who first embodied the principles of Quietism in his works, which were condemned at Rome, where the author was imprisoned and died in 1696. About the same time Madame Guyon or Guion, in France, showed herself a great advocate of Quietism. The Archbishop of Paris styled the contents of her books "a monstrous and diabolical system." Fénelon undertook her defence, and this led to a hot controversy between him and Bossuet, and ended in the condemnation of the former by the Pope in 1699. Madame Guyon, who had in the meantime been imprisoned, was at last liberated. She died in 1717. See also BOSSUET, FÉNELON, GUYON, and MOLINOS; and MYSTICISM.

QUIMPER, a town of France, the capital of the department of Finistère, situated on the Odet, 35 miles S.E. of Brest, at the head of the Anse or inlet of Benodet. It consists of an old and a new town, the former surrounded by walls flanked with towers, and has a Gothic cathedral, college, library, theatre, &c. The manufactures are hats and stoneware, and at the harbour there is considerable sardine fishery and shipbuilding. There is a Welsh Baptist mission church here. The population in 1881 was 15,288. Quimper derived its present name from its first bishop, in the fifth century, previous to which it was called *Coriospitum*. It was sacked by Charles of Blois in the year 1345.

QUINAULT, PHILIPPE, dramatist, and the first celebrated writer of French operas, was born at Paris in 1635. His fame rests upon his connection with the celebrated composer Lully, which lasted fourteen years, during which he wrote seventeen operas, beginning with "Les Fêtes d'Amour et de Bacchus," and ending with his masterpiece, "Armide." Quinault was a member of the French Academy and the Academy of Inscriptions and Belles Lettres, and received from Louis XIV., whose admiration of his genius was excessive, the order of St. Michael and a pension of 200 livres. He died in 1688.

QUINCE (*Cytisonia vulgaris*) is a species of the order ROSACEÆ, suborder POMACEÆ, and is only distinguished from the genus PYRUS by having many seeds in each cell of the fruit instead of two only, and by the seeds being enveloped in mucilage. Bentham and Hooker, in their "Genera Plantarum," rank it as a subgenus of PYRUS. The quince is found in Southern Europe, South-west Asia, extending to the north of India, and in the north of Africa; but in Europe it is not perhaps truly indigenous, but has become naturalized through long cultivation. It is a tree growing to a height of 15 or 20 feet, with numerous crooked branches, forming a bushy spreading head. The large white or rose-coloured flowers are solitary on the ends of short branches, bearing five or six leaves, and appear late in spring. The fruit is ripe in November. It is large, usually pear or apple shaped, smooth when mature, and of a fine golden yellow colour. It has a strong, fragrant odour, but the flesh is hard and very austere, so that it is unfit for eating raw. It is used for making preserves, marmalade, and jellies, and is also added to apples in pies. The seeds are used medicinally on account of the mucilage which they yield; they are more numerous in the small hard fruits than in the large fleshy fruits. They generally occur in irregularly shaped masses, as they easily adhere to each other, owing to the mucus which invests them. When moistened in the mouth or in water, they give out a large quantity of mucilage, which is white, and not coagulable by boric acid. Many seeds yield a yellow-coloured mucilage. If allowed to remain in a fluid state the solution soon spoils; but by careful evaporation the mucilage may be brought to a dry state, or precipitated from its

watery solution by alcohol. In whatever way obtained, the mucilage possesses demulcent qualities, and may be employed either internally or as a lotion, which is especially applicable to the faces of those who suffer from the cold winds of winter and spring. Three varieties are cultivated in England—the apple-shaped quince, the pear-shaped quince, and the Portugal quince; the last of these varieties has larger, less austere fruits.

*The quince is greatly used as a stock upon which to bud or graft the pear, which is then much dwarfed and fruits very early. It is propagated readily by cuttings or by layering. The famous golden apples of the Hesperides, as well as that fateful prize of beauty which the Trojan Paris awarded to Aphrodite, are considered to have been quinces.

The Japanese Quince (*Cydonia japonica*) is largely cultivated as an ornamental shrub in gardens; it is usually trained to walls, and attains a height of 15 feet. The flowers, which are produced in winter or early spring, are large and vary from creamy white to a bright red colour. The fruit is yellowish-green, and quite uneatable, but often preserved on account of its fragrance.

The Chinese Quince (*Cydonia sinensis*), a native of China, is occasionally cultivated in this country, where it forms a handsome though low tree, being only about 10 feet high. The fruit is large, egg-shaped, greenish, hard, and nearly dry.

QUINCEY, DE. See DE QUINCEY, THOMAS.

QUINCTIUS or QUINTIUS was the name of one of the most famous patrician clans or *gentes* of Rome, and was brought to the city from Alba Larga by King Tullus Hostilius. All through the times of the great republic a Quinctius is sure to be prominent. The three great Quintian families were Quintus FLAMINIUS, Quintus CATTOLINUS, and Quintus CINCINNATUS, and the famous Quintii are noticed under these separate headings.

QUIN'CUNX strictly means five-twelfths. Thus it was the name of the Roman bronze coin, equal in value to five-twelfths of the *as*, that is, weighing 5 ounces (*uncie*). But its modern use is to signify a method of planting trees in the way to obtain the most light and air that can be acquired in a given case. The trees are in groups of five, four at the corners of a square and one at the centre, like the figure on the five side of dice.

QUINDEC'AGON, a plane geometrical figure of fifteen sides and fifteen angles.

QUINET, EDGAR, an eminent historian, philosopher, and professor, was born in 1803. After completing his studies in France with great distinction he went to Germany, and became noted for his learning and talents. In 1839 he obtained the chair of foreign literature at Lyons, and in 1842 the newly-founded chair of the languages and literature of Southern Europe in the College of France. In conjunction with Michelet he, both by lectures and writings, propounded those views against Ultramontanism which led to his being deprived of his chair in 1848. He took an active part in the revolution of 1848. Exiled by the decree of 1852, M. Quinet went to Brussels, and afterwards to Switzerland, opposing the second empire and continuing his literary labours till his return to Paris under the imperial permission in 1870, when he was restored to his chair in the College of France, and in 1871 was elected as representative of the Seine in the National Assembly. He formed, with Louis Blanc, Peyrat, Naquet, Madier de Montjau, and Ordinaire, that little group of the extreme left, called the Irreconcilables. His best known books are "Abasnerus," "Travels in Spain," "Studies of Homer," the "Life of Jesus," "Modern Greece," "The Jesuits and the Revolution." He died 27th March, 1875.

QUIN'IBLE, an organum or second part above a given melody, produced by singing a succession of Fifths above that melody, an effect unbearable now, but much appreci-

ated in the dark ages as the beginning of harmony. Thus Chaucer ("Miller's Tale")—

"In twenty manere could he trip and dance,
And playen songes on a small ribble,
Thereto he song sometime a loud quible."

QUIN'IC or KINIC ACID, an acid obtained from cinchona bark, *Cinchona calisaya*, natural order Cinchonaceae, in which it was detected by Hoffmann in 1785. It has since been found in the bilberry, coffee, holly, ivy, privet, oak, ash, elm, and other plants. It is obtained in white prismatic tabular crystals, having the formula $C_7H_{12}O_6$. It is very soluble both in hot and cold water, slightly soluble in alcohol, but insoluble in ether; when heated to 225° C. (437° Fahr.) it loses water, and is converted into quinide ($C_7H_{10}O_6$), which is quinic anhydride. Distilled with sulphuric acid and manganese peroxide, it yields a yellow crystalline sublimate of quinone ($C_6H_4O_2$). This reaction is very characteristic, and a delicate test for the presence of quinic acid in cinchona bark. Heated with hydriodic acid it is converted into benzoic acid ($C_7H_6O_2$). It forms a number of salts, having the general formula $C_7H_{11}MO_6$. These are mostly crystallizable and neutral, and with the exception of the basic lead salt, soluble in water, but insoluble in alcohol. On dry distillation these salts yield formic acid and quinone. It forms an ether, called quinic ether, $C_7H_{11}(C_2H_5)O_6$, which is a yellow, bitter, aromatic syrup.

QUIN'ICINE is an alkaloid, isomeric with quinine, and obtained from that bark, and having the formula $C_{20}H_{22}N_2O_2$. It is insoluble in water, but very soluble in alcohol. It precipitates from solution as a fluid resin, and is a bitter febrifuge.

QUIN'IDINE. This alkaloid is found in some cinchona barks, with quinine and cinchonine, particularly in the red barks, *Cinchona officinalis* and *Cinchona succirubra*. It is obtained in large transparent prismatic crystals, having the formula $C_{20}H_{24}N_2O_2 + 2H_2O$. It is slightly soluble in hot and cold water, very soluble in alcohol and in ether. Its solutions are coloured green by chlorine water and ammonia, the same as those of quinine; if, however, ferrocyanide of potassium be also added a precipitate is produced, which is not the case with quinine. It forms a great number of salts, resembling those of quinine, but much more crystallizable. It forms mono- and di-acid salts, and these are more soluble than the corresponding salts of quinine. The solutions are equally fluorescent. The hydrochlorate ($C_{20}H_{24}N_2O_2HCl$) forms double salts with the chlorides of gold, mercury, platinum, and zinc. The salt used in medicine is the sulphate ($2C_{20}H_{24}N_2O_2SO_4 \cdot 6H_2O$). It is administered in doses of from 1 to 20 grains, and only requires the addition of a little sulphuric acid to make it very soluble in water. It is a powerful antiperiodic, almost equal to the quinine salt, and is suitable for giving to children, as it is less bitter than the other cinchona alkaloids.

QUININE. This important alkaloid was first obtained from cinchona bark by Pfaff in 1811, but its composition was first established by Liebig in 1838. The best yellow bark, *Cinchona calisaya*, contains about 2 per cent. These barks came originally from Peru and Bolivia, hence the name Peruvian bark; but the trees have now been introduced into India, where there are thriving plantations under government, and from which the alkaloids are obtained in a crude mixed form for local use in India. The extraction of quinine for medicinal purposes forms a large manufacture in England, France, and Germany. The bark is usually extracted with a dilute mineral acid, and the alkaloids precipitated by lime. From this precipitate the quinine was generally dissolved out by alcohol. Benzine or amyl alcohol (fusel oil) is now employed as a cheaper and better solvent. The quinine is dissolved in dilute sulphuric acid, and the sulphate purified by recrystallization. Quinine is precipitated from solution by an alkali, as a

white curdy precipitate, which dries into a white opaque mass, and melts to a resin on heating; it is very bitter. The formula is $C_{20}H_{22}N_2O_2$. It forms three hydrates. It is soluble in 200 parts of boiling water, and is very soluble in alcohol and ether, also in chloroform and volatile and fixed oils. With zinc and dilute sulphuric acid it forms hydroquinone ($C_{20}H_{22}N_2O_3$). With chlorine water and excess of ammonia a fine emerald green fluid is obtained. The colour is not produced by other alkalis.

Quinine forms mono- and di-acid salts, all highly crystalline, and mostly forming silky crystals, soluble in water, especially the di-acid salts, and the solutions of these are highly fluorescent. The hydrochlorate, $2(C_{20}H_{22}N_2O_2 \cdot HCl) \cdot 3H_2O$, forms double salts with the chlorides of gold, platinum, and mercury. The most important salt in commerce is the sulphate, $2C_{20}H_{22}N_2O_2 \cdot H_2SO_4$. It is soluble in 793 parts of water. It crystallizes in silky needles. The sulphate of iodoquinine, $2C_{20}H_{22}N_2O_2 \cdot 3HI \cdot SO_4 \cdot I_2$, is known as Herapath's artificial tourmaline. This is a beautiful salt occurring in large rectangular, octagonal, or hexagonal plates, emerald green by reflected light, and nearly colourless by transmitted light. These crystals when placed across one another intercept the light exactly in the same manner as natural tourmalines, and may be employed as a substitute in the microscope for experiments with polarized light.

The sulphate is commonly employed in medicine as the most convenient and easily prepared salt, and is usually known in commerce as "quinine." It is used in doses of from 1 to 5 grains as a tonic, and in 5 to 15 grain doses as an antiperiodic. The solution possesses powerful antiseptic properties, and it is employed as an eye lotion in diphtheritic ophthalmia. The following salts of quinine are also used in medicine:—The chlorate, citrate, hydrobromate, for hypodermic injection; hydrochlorate, as a germicide; salicylate, for rheumatic gout; sulphocarbonate, valerianate, for nervous headache and hysteria. Quinine is the most valuable remedy for ague, and it is absolutely necessary in some countries.

The great importance and value of quinine has long made it the subject of numerous researches by chemists with the hope of obtaining it artificially. This hope has not yet been realized, and it still remains the El Dorado of the laboratory. The French government have for many years offered a large money prize for the discovery, though even this would represent but a small part of the value to the fortunate discoverer. These researches have, however, led to a number of other very valuable discoveries, for instance, that of the coal-tar colours by Perkin.

QUINO'A (*Chenopodium Quinoa*) is an annual herb belonging to the order of plants **CHENOPODIACEÆ**, and to the same genus as the Common British goosefoot. It is a native of the Pacific slopes of the Andes. It has an erect stem about 4 or 5 feet high, with large ovate, deeply sinuate leaves, and dense axillary and terminal clusters of



The Quinoa Plant.

small green flowers. It is largely cultivated by the natives in Chili and Peru for the sake of its seeds, which form a great part of their food. The seeds are ground into a nutritious meal, somewhat resembling oatmeal, and used in the form of gruel or made into cakes. A kind of broth is also made by slightly roasting the seeds and boiling them in water, which is then strained and seasoned with

condiments. A decoction of the red seeds of another variety is used medicinally as an application for sores and bruises. The leaves have also been used like spinach.

QUINONE, a substance obtained from quinic acid by oxidation. It sublimes in golden yellow shining needles. The formula is $C_{10}H_6O_2$. It melts at 100° C. (212° Fahr.) to a yellow liquid, which crystallizes on cooling. It is insoluble in water, but soluble in alcohol and ether. It forms substitution compounds with chlorine—monochloroquinone, $C_6H_5ClO_2$; dichloroquinone, $C_6H_4Cl_2O_2$; trichloroquinone, $C_6H_3Cl_3O_2$; and tetrachloroquinone or chloranil, $C_6Cl_4O_2$. All are golden yellow crystalline compounds, soluble in ether. Chloranil, by the action of potash, produces chloranilic acid, $C_6H_2Cl_2O_4$, which is soluble in water, with a violet colour.

QUINQUAGES'IMA (Lat., fiftieth), originally signified the fiftieth day after Easter, but it is now used to designate the Sunday immediately preceding Ash Wednesday, which happens to be the fiftieth day before Easter.

QUIN'QUEREME, an ancient war-galley, with five banks of oars. See **TRIREME**.

QUIN'SY, INFLAMMATORY SORE-THROAT,

or **TONSILITIS**, is an affection most commonly met with in young persons during the variable weather of spring or autumn, but which also not unfrequently attacks adults, and may at any time be induced by exposure to cold, damp, or wet. It was formerly supposed to be infectious, but there does not appear to be much evidence in support of this view, though in certain states of the weather so many persons are attacked that the disease presents the appearance of an epidemic. One attack of the disease usually predisposes to another. The symptoms vary considerably in different cases, but they usually set in with indications of fever. The patient after experiencing a general feeling of uneasiness, suffers from headache, pains in the limbs, with a sense of chill and possibly fits of shivering. The pulse is rapid, reaching 120 beats in the minute, while the temperature rises to 102° Fahr., or even higher. The tongue becomes coated with a thick heavy yellowish fur, the breath is offensive, and salivation is complained of; there is also a good deal of irritability and excitement, especially at night, and this in the very young may amount to delirium. As these symptoms become manifest, the patient also becomes aware of a feeling of dryness and uneasiness in the throat, which increases until it amounts to severe pain, shooting up to the ear on the affected side. Externally large, firm, and very sensitive that it becomes impossible to open the mouth widely, and swellings appear behind the angles of the lower jaw, so very frequently the whole neck becomes stiff and swollen. The tone of the voice is altered, becoming thick, guttural, and nasal, swallowing becomes painful and difficult, fluids often returning through the nostrils, while the patient feels as if the throat were blocked up completely. An examination of the parts internally reveals the fact that one tonsil is greatly swollen and of a bright red colour, while the soft palate and uvula are also involved in the inflammation. Sometimes, but rarely, both tonsils are involved, and occasionally the patient is affected with deafness on one or both sides. This state of things may continue for four or five days, and then it may gradually pass away, the inflammation subsiding by degrees until the patient is able to resume his usual avocations, but more frequently the inflammation terminates in the formation of matter. In the latter case the symptoms are aggravated, and attended with pain and throbbing immediately before the formation of pus, the discomfort extending upwards towards the ear. The abscess may require to be evacuated by pricking, but more usually it bursts during the act of swallowing or coughing, the matter discharged having generally a very unpleasant smell and taste. The bursting of the abscess is attended with an immediate and striking sense of relief,

and after it has taken place convalescence speedily follows. The complaint, though troublesome, is rarely if ever fatal. It commonly only lasts five or six days, but sometimes the patient is confined to the house for ten days or a fortnight.

With respect to the treatment of this disease, if taken at the outset, it may be possible to avert the ordinary symptoms by the administration of aconite in doses of one drop of the tincture in a little water, three times an hour for two hours, and afterwards hourly. If there is much prostration, with weak and feeble pulse, a smaller dose should be given. Where this remedy is effectual its benefits become manifest in a few hours, the signs of relief being the appearance of a profuse perspiration, attended with a reduction of the pulse and a disappearance of the more troublesome local symptoms, the patient regaining his normal condition within a couple of days or thereabouts. Where the disease has become established, or where the abortive treatment has failed, the patient should be confined to bed; hot poultices should be constantly kept round the throat; steam should be inhaled as frequently as possible, and the air of the room should be kept moist if possible by means of the steam from a kettle; and gurgles of warm milk and water should be used at least every hour. When the bowels are confined a brisk saline purgative may be administered. Ice, if found grateful, may be allowed at discretion; it should be broken into small pieces about the size of a nut and given to the patient to suck. The diet will of necessity be in a liquid or semi-solid form, and it should be of a simple and nourishing character. When convalescence sets in tonic medicines, such as quinine and iron, are useful, and where there has been a discharge of matter, astringent gurgles should be made use of for some time after convalescence is established.

The odd-looking word *quinsy* has an odd history. It was originally in Greek the dog-choke (*kunankê*), that throat-swelling which throttled the sufferer as if with the grip of a dog (*kunōn*, *kunos*, a dog; *anghchia*, to choke). From this the transition to the Old French *quinancie*, intensified into *esquinancie* (sixteenth century), was not difficult. Hence we get the sixteenth-century English *sqinancie*, and the later *squinzie* (cotton), Jeremy Taylor's *sqinzeey*, and thus *quinsy*, by dropping the letter *s*.

QUINT (Lat. *quintus*, fifth), an organ stop sounding a fifth above the 8-foot diapasons on the manual, having therefore a scale of $5\frac{1}{2}$ feet. On the pedals it is a fifth above the Bourdon (10 $\frac{1}{2}$ feet scale); and if the balance of tone of the two stops is very nicely adjusted their combination will represent the 32 feet tone to the ear, as they form the second and third partials of the 32 feet, and by a well-known law of acoustics their union indicates their prime. The quint on the pedals is, however, most successful in conjunction with a 32-feet stop and a soft 16, when it produces a wonderfully rich and peculiar effect.

QUIN'TAIN, an early English game of the tilt-yard. A post was set up, turning on a pivot, and bearing an outstretched arm, so that the unskilful tilter who struck it otherwise than on the mark was struck and perhaps knocked from off his horse by the forcible revolution of the post and the swinging round of the outstretched arm. The arm was usually loaded with a bag of sand. The quintain was often in the shape of a man holding out a pole or beam. The origin of the word is from Lat. *quintana*, the fifth avenue (*quintus*, fifth) of a Roman camp, which always served as the market, exchange, and recreation ground of the fortified inclosure.

QUIN'TAL, the French hundredweight, was equal to 100 livres (French pounds), and has accordingly been used to express 100 kilogrammes in the present French metric system of weight, although, as the kilogramme is about half the livre in weight, the quintal of to-day is to that of former times as 409 to 400.

QUIN'TATON or **QUINTATEN**, an organ stop of closed metal pipes of small scale; the effect of which peculiar construction is to allow the octave-quint or twelfth, that is, the third partial, to be heard very clearly with the prime tone. The effect is consequently metallic and brilliant.

QUINTER'NA or **CHITERNA**, a stringed instrument somewhat resembling a violin, though really it is of the guitar family, and is played like a guitar by plucking with the finger. It has three pairs of catgut strings and two covered strings, wire on gut, with frets made of catgut bindings. The quinterna was the favourite instrument of the Italians of the lower orders during the sixteenth and seventeenth centuries for accompanying songs and dances. It was often beautifully ornamented with tortoise-shell, ivory, and mother-of-pearl. There are some fine specimens at South Kensington, the best being by Joachim Tielke of Hamburg, 1539.

QUINTET' (Ital.) in music, a vocal or instrumental composition in five parts, each of which is performed by a single voice or instrument.

QUINTIL'IAN (*Quintilianus*, *Marcus Fabius*). There is sufficient evidence in the works of Quintilian to prove that he was educated, if not born, at Rome; and it is certain that he must have lived at Rome at least as early as A.D. 59. He was probably a Spaniard, and born about A.D. 40. St. Jerome says that he was the first rhetorician who received a salary from the exchequer. He practised as an advocate with great reputation, and also taught rhetoric for twenty years. He retired in 89, and died about 118 A.D. Juvenal speaks of him as having been promoted to the rank of senator. He was a friend of Galba, and Domitian granted him the rank and insignia of a consul. He taught this emperor's two grand-nephews, and also was the master of Pliny the Younger.

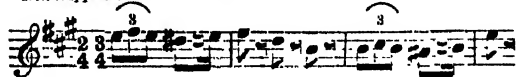
In the preface to the sixth book of his work on the education of an orator, Quintilian laments the death of his wife and two sons, and complains that there was no providence in the government of human affairs. This great work, "*Institutio Oratoria*," was written in the reign of Domitian, on whom he lavishes the most extravagant adulation. It is divided into twelve books. The object is not merely to give the chief rules of rhetoric, but also to lay down a course of education for an orator.

The first complete MS. of the "*Institutes*" of Quintilian was discovered in 1417, by Poggio Bracciolini, in the monastery of St. Gall. On the revival of learning it was studied more than any other Latin author. The diction is graceful and the matter very valuable. There is a full account of the pronunciation of the various letters, a history of Greek and Roman literature, brief, but very spirited, and many other matters of unique antiquarian interest. In itself the work was very practical and useful in its time.

The best edition of the "*Institutes*" is by Spalding (Leipzig, 1798-1816, four vols. 8vo), to which a volume of notes was added by Zumpt (Leipzig, 1829, 8vo). There is an English translation by Guthrie (London, 1756, two vols. 8vo), and one by Patsall (London, 1774, two vols. 8vo).

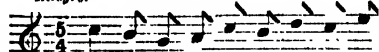
QUIN'TUPLE TIME or **RHYTHM**, a musical rhythm with five beats in a bar, usually divided into a triple and a triple rhythm alternately; thus in Hiller's Trio, op. 64, with 2, 3, as time signature—

Non troppo vivo



But occasionally a true quintuple rhythm is encountered, as in Reeves' famous "*Gypsies' Glee*" (1796)—

Allegro.



QUIN'TUS CUR'TIUS RU'FUS. Nothing is known from extrinsic evidence of the personal history of Quintus Curtius, or of the time when he lived; nor is there a single passage in his work from which anything can be deduced with certainty. Joining together many slight indications, it is perhaps warrantable to place him under Vespasian.

His great work, "*De Rebus Alexandri Magni Regis Macedonum*" (Acts of Alexander the Great, king of the Macedonians), was originally in ten books, of which the first two are lost; the third book begins with the attack of Alexander on Celenæ. There seems also to be something wanting at the end of the fifth and the beginning of the sixth books; and perhaps there are some omissions in the tenth book also. The supplement to Curtius by Freinshemius is useful. The work itself is excellent, modelled on Livy, whose clearness and interest it almost rivals. It is not critical, nor is it very accurate.

One of the best English translations was by Digby (London, 1714-26, two vols. 12mo), revised by Yonge in 1747.

QUIR'INAL, the name of one of the hills of Rome, derived from the worship of Mars under the name of Quirinus, which was conducted there. In the earliest times there was certainly a Sabine city on the Quirinal over against the city on the Palatine; the patron god of the one being Quirinus, that of the other Mars. The absorption of the Quirinal city into the Roman has left few traces in history. The royal palace stands on the Quirinal.

QUIR'INUS ("the Spear-brandisher"), from *quiris*, a Sabine word for spear or lance. It is an epithet of a god of war, afterwards identified with the Roman Mars. The word serves also as a name of Romulus, of the god Janus, and of Augustus the emperor, who were all worshipped under this name.

QUIR'ITES, a name given to the fully qualified burghesses of ancient Rome, originally the sole bearers of arms, whence the name "lance bearers," *quiris* being a lance or spear.

QUIT RENT, in law, a small rent payable by tenants of manors, anciently payable in silver money (the Old English *hwit* or *white* rent, silver being white money), and having nothing to do with the tenant being "quit" of all further obligation.

QUITO, the capital of the republic of Ecuador, in South America, is situated 90 miles from the Pacific, at an elevation of 9534 feet above the level of the sea. This great elevation, and its position, only 15 miles south of the equator, render the climate very mild all the year round; in fact it may be compared with the finest spring weather in England, but from December to March violent storms of rain and lightning occur almost daily in the afternoon. Vegetation never ceases at any period of the year. Its delightful climate, together with the beautiful scenery which surrounds the capital, renders Quito one of the most charming cities in South America. The temperature of the air at noon generally varies between 60 and 67 degrees, and that of the coldest part of the night between 52 and 56 degrees. A small portion of the town is built on level ground, and the remainder on the declivity of a hill. The cathedral and the archiepiscopal palace stand opposite to one another, in the great square, on the level ground, the other two sides of which are occupied by the government palace and the town hall. The lower declivities are furrowed by numerous ravines, some of which are of considerable depth. This circumstance renders the streets very uneven and irregular. There are numerous convents; that of the Franciscans is a vast edifice, and both magnificent and tasteful. The other public buildings of the city comprise many fine churches, a public seminary, free library, containing about 20,000 volumes; the ex-Jesuits' college, which contains a large library and halls, now appropriated to the university; the penitentiary, a very fine building, erected in 1874; an orphan asylum, large hospital, and a

workhouse. The president of the republic resides at Quito. The greater part of the houses are built of bricks dried in the sun; and in order that they may suffer less from the frequent earthquakes, they are only one storey high. The roofs are flat, and are covered with the leaves of the American aloe. The population has been variously estimated at from 25,000 to 80,000.

Silver and gold were formerly worked extensively in the neighbourhood, and there are still some manufactures of coarse cotton and woollen goods, of lace, silk, hosiery, jewelry, confectionery, and leather carried on. There is also an active trade in iron, steel, indigo, corn, and other agricultural produce, brandy, wine, oil, and the precious metals. During the eruption of Pichincha, a volcano on its west side, in 1797, the city was surrounded by lava. It was nearly destroyed by an earthquake in 1859, when 5000 of the population perished. Eleven snow-capped mountains can be seen from Quito.

QUIX'OTE, DON. See CERVANTES.

QUO WAR'RANTO was the name of a prerogative writ issuing out of the Queen's Bench Division, on behalf of the crown against any person or corporation that had usurped or unjustly claimed any public office or other franchise or liberty, or that, having originally had a grant of one, had forfeited it by abuse or neglect. By this the defendant was called on to show *by what warrant* (*quo warranto*, whence the name of the writ) he exercised the office, liberty, or franchise in question. The writ has been supplanted in practice by a proceeding called an *information in the nature of a quo warranto* filed by the attorney general, which is more speedy in its action. In Scotland similar questions are tried in the Court of Session under actions of declarator of right and title, or by suspension and interdict against a party claiming or assuming a right.

QUOIN (Fr. *coigne*; Gr. *gouia*), in architecture, the corner or external and internal angle of a building, or of any part of a building. The term is usually applied to the stones which form the angles, and which, when they project or are moulded, are called "rustic quoins." In artillery the quoin is a wedge inserted beneath the breech of a gun, either to elevate or depress the muzzle. Guns of the latest pattern are raised by means of a screw.

QUOITS, the modern equivalent to the classical *diskos* or *discus*, so favourite a pastime with the ancient Greeks and Romans. The quoit is a flattened ring of iron, 8 or 9 inches in diameter, convex on the upper side, concave with a shallow curve on the under side, so that the rim is sufficiently sharp all round to stick into soft ground if the quoit is thrown so as to come down edgewise. Two marks are set 22 yards apart more or less, about a wicket length at cricket. The players then throw from one mark to the other, and the player whose quoit sticks in the ground nearest to the mark (technically the *hob*) scores. It is allowable to drive an opponent's quoit out of the ground if possible; and it is allowable to ring the hob, i.e. let the quoit fall so that the hob comes through its centre. The hobs are usually set in patches of clay, kept artificially moist.

The ancient discus does not appear to have been thrown at a mark, but for mere distance, the longest throw winning. But the information is not very accurate.

QUO'RUM. See SESSIONS.

QUOTATION MARKS, in printing, one or two inverted commas placed at the beginning and one or two direct commas (or apostrophes) at the end of a sentence or phrase transcribed from some other author. Thus:—

'Virtue alone is happiness below.'

Or

"Virtue alone is happiness below."—*Pope*.

The Germans call them *gänse-äugen*, or goose-eyes, and the French, *guillemets*, from their inventor, Guillemet.

4. **R** is one of the vibrating letters called liquids in popular usage: more strictly it is a trilled spirant, verging towards a sibilant. It is formed at the back of the palate, and is on this account more nearly related to the liquid *l*, and even to the sibilants *s*, *sh*, *zh*, than to *n* or *m*. It is convertible—

1. With *l*. Thus *puera*, *tener*, *umbra*, *castrum* form as their diminutives, not *puerula*, *tenerulus*, *umberula*, *castrulum*, but *puella*, *tenellus*, *umbella*, *castellum*; also *per*, *inter*, *super*, and *pro*, prefixed to words beginning with an *l*, readily assimilate their liquid, as in *pellicere*, *pellucidus*, *intelligere*, *impeller*. So again we find *velle* when we might expect *rehere*. Similarly *origo* has an aorist *εἰλον*, and *εἰσχασι* an aorist *ἔλυσον* or *ἔλβον*. Some of the South Sea Islanders, it is said, are wholly unable to appreciate any difference between *r* and *l*; and the Mexicans, with an abundance of *ls*, had no *r* in their speech. The French *rossignol*, *chapitre*, *chartre*, are the Latin *lusciniola*, *capitulum*, *cartula*, &c.

2. With *u*. See the Greek *διακονος* and Latin *decanus*, compared with the French *diacre*; the ancient Latin *ordo*n (whence Nom. *ordo*, Gen. *ordinis*), with the French *ordre*, and English *order*. So the Latin *homo*n (Nom. *homo*), *femina*, *nomen*, become in Spanish *hombre*, *hembra*, *nombre*. *Londinium* (London) becomes in French *Londres*. Other examples of a triple set with *n*, *r*, and *s* occur in the plural suffixes of the English language (*es*, *er*, *en*); and in suffixes of the genitives plural *rum* in Latin, *sām* in Sanskrit, *nam* in Zend.

3. *R* final with *ru*. Hence the double forms of the Latin verbs *cer* and *cern*, separate; *ster* and *stern*, strew; *asper* and *spurn*, kick, despise. Again *star* (and the Latin must once have had *stera* in order to form from it the diminutive *stella*, as from *puera* comes *puella*) is in German *stern*. *Spur* in English is *sporn* in German. The Latin *bur* (in *con-bur-o*) is the same word as the English *burn*; and even the Latin *curr-ere*, to run, has in Gothic the form *urn-an*, just as the south-western dialect of England has *hurn*, and the ordinary English, by a slipping of the *r*, *run*. In the same south-western dialect *be-forne*, *araurn*, *orn*, *uorn*, *onrn*, are the forms employed for *before*, *afore*, or either (Ger. *oder*), *nor* or *neither*, *our*.

4. With *s*. This change occurs to such a degree in the Latin language that one is almost at liberty to affirm that at an early period the letter *r* was unknown to the language, for every *r* in the Latin dialect seems to have been originally an *s*. *Eram*, *gero*, *uro*, *haurio*, *marceo*, *carco*, stand in connection respectively with *esse*, *gessi*, *ussi*, *hausi*, *mæstus*, *castus*. *Infestus* is only a participle of *infesto*. So again the genitives *maris*, *moris*, *maris*, *avis*, *operis*, have for their nominatives *mas*, *mos*, *mus*, *as*, *opus*; while the nouns *rumor*, *arbor*, *grandior*, form diminutives *rumusculus*, *arbuscula*, *grandiusculus*. The perfect tense, third person, *amarunt*, must once have been *amæsunt*, being formed by the addition of the auxiliary verb *esse*, like the passive *axati sunt*. The word *ara*, altar, was originally *asa*, and the proper names *Furius* and *Papirius* were *Fusius* and *Papisius*. It may be remarked, too, that in these changes, if the *s* is preceded by a short *i*, the supplanting *r* forthwith assumes a short *e*. Thus *pulvis* and *cucumis* (in which the *s* is part of the word, not merely a nominative suffix, as in *maris*), when they take a second syllable *is*, to represent the genitive case, change the first *i* into *er*, as *pulveris*, *cucumeris*. In English we have *are* in the same tense with *is*, *were*

with *was*, and it is an error to consider the *r* in these forms as the symbol of plurality. Often the English has an *r* where the German has *s*, as Ger. *hase*, Eng. *hare*. Still plainer signs of the kinship between these letters are *forlorn* = *forloren*, lost; *frore* or *fracen* = *frösen* or *frozen*; Old English *isern*, High German *eisen* = Modern English *iron*; Gothic *auso*, Old English *care* = Modern English *care*.

5. *R* is apt to place itself at one time before, at another after a vowel. Thus in Greek *περοδιδλος* or *περοδιδλος*, *πρασος* or *πρασος*. So the English words *red*, *run*, are in the west country dialects *hird*, *hira*. Again, *brid* is an old form of *bird*, and *brod* of *board*; while the town *Bridlington* is locally pronounced *Burlington*.

6. The letter *r*, in the neighbourhood of several consonants, is apt to disappear from words. Thus the Old English *sprecen* is our *speak*. Our *pin* was *preon* to our ancestors, and is still *preen* in Scotch; *palsey* is from the Greek *paralysis*; another example is *cockade*, from the Old French *cocart*. Also, *r* often drives out *k*; thus Old English *hring* becomes *ring*, *hrine* becomes *vine*; and *t* or *d*, as *square* for Latin *quadratum*, *pierre* (French) for Latin *petra*, *verre* for *vitrum*, &c.

7. In one language a word is found with an initial *r*, when in other allied languages there occur at the beginning two consonants, as *br*, *fr*, *wr*. Thus in Greek we have *ῥόδον*, *ῥηνυμν*, *ῥίζω*, connected with which are the forms *βροδον*, *φράγν*, Latin, and *break*, English; and the English words *wreak*, *work*, *wrought*.

8. *R* has thrust itself into several English words. The Old English *gūna* becomes (bride) groom; Old English *hōa* is our *hourse*; *partridge* is the Latin *perdix*; *cartridge*, *corporeal*, the French *cartouche*, *caporal*; *culprit* is the Latin *culpatus*.

In very early inscriptions in Italy we find traces of two distinct alphabets, both of Greek derivation, one more archaic than the other, and the older alphabet confined to Tuscany, Etruria, &c. Among other differences the ancient Tuscan alphabet had the unaltered Greek *P* as its *r*; while the ancient Latin had the later modification *R*.

R is popularly the dog's letter, because of its likeness to a dog's snarling growl—as Shakspeare reminds us in "Romeo and Juliet," ii. 4, "That's the dog's name: *R* is for the dog." The familiar *R* in prescriptions stands for the letter *R* and the sign *℞* of the planet Jupiter in combination. *R* is for *recipe* ("take" such and such quantities of so and so), and the stroke, a contraction of the sign for Jupiter, is the remains of the ancient Roman invocation to the father of the gods that he would assist the prescription with his sovran aid; as if one were to say, "Jupiter aiding, take of the following drugs as ordered." The contraction *R.I.P.*, so common in epitaphs, stands for *Requiescat in pace*, Let him rest in peace.

RA was the name of the sun-god of ancient Egypt, usually used as an attribute or manifestation of the great god Amen or Amun, "the hidden one." Amen-Ra was the chief divinity of Upper Egypt, and in this term Amen would almost seem to mean the word god or the universally underlying divine principle, Ra the special divinity of the sun. The Greeks translated Ra by Ἥλιος (the sun), and called his great city Heliopolis, which is close by the modern Cairo. Neith, goddess of the upper air (the Greek Athênê), was his mother; Mist, the goddess of earth (the Greek Dêmêtrê), was his wife; Athor (the Greek Aphroditê) was his daughter. From the god's name with the

prefixed syllable *Pi* came his alternative name *Phrab*, whence the "divine" monarchs of Egypt, the Pharaohs. Every Pharaoh was thus styled "son of the sun."

RAAB (*Győr*), a town in Hungary, of about 20,000 inhabitants, situated on an extensive marshy plain, where the rivers Raab and Rábúitz fall into the arm of the Danube that incloses the *Kleine-Schutt* on the south, and it is nearly surrounded by those three rivers. The town is midway between Vienna and Buda-Pesth, being 67 miles distant from both. A railway joins Raab to the Vienna-Trieste line; and it is also a steam-packet station. At a distance the steeples of its numerous churches give it a striking appearance. The streets are pretty regular and well paved, and there are many handsome houses. Raab is divided into what is called the inner town and the extensive suburbs. There are several Roman Catholic churches, of which the most remarkable are the Church of the Benedictines, and the cathedral, with a splendid choir and marble altars. There are also Lutheran and Greek churches. The other public buildings are not of special importance. Raab was a place of strength in the time of the Romans. In 1593 the fortress fell into the hands of the Turks, but was retaken by the Austrians in 1598. On the 14th of June, 1809, the French, having defeated the Hungarians, under the Archduke John, near the town, laid siege to it, and became masters of it on the 24th, by capitulation. In the famous sortie of General Klapka from the fortress of Komorn during the last revolutionary war in Hungary, a large Austrian force was driven from Raab (3rd August, 1849) with the loss of an immense quantity of arms and provisions; the Austrians, however, reoccupied the town on the 15th. The site of the old ramparts, which were levelled in 1820, has been partly converted into public walks and partly used for new and handsome streets. The manufactures, of tobacco, woollen cloth, cutlery, and vinegar, are considerable. Three annual fairs are held, and the town carries on a very brisk trade—chiefly in corn—in consequence of its very favourable situation.

RABAT or **NEW SALLÉE**, a town of Morocco, 102 miles west of Fez, situated on the Atlantic, at the mouth of the Bu-regreg, opposite Old Sallée, and standing on a height. It is surrounded by a vast extent of turreted walls, the space between them and the houses being occupied with kitchen gardens; the side towards the sea is defended by batteries. The streets are narrow and steep, and the harbour is safe, except during westerly winds, but there is a dangerous bar at the mouth of the river. Owing to this cottons, sugar, and tea, and various other articles necessary to the existence of the well-to-do Moor, have to be brought to Dar-al-Beida, a small but flourishing port about 60 miles to the southward, and are then carried to Rabat overland on camels; but direct trade is on the increase, and a considerable quantity of wool is sent to Liverpool. The inhabitants of Rabat are well known for their skill in the manufacture of carpets, huicks, and other woollen stuffs, their pottery, and the curing of the famous Morocco leather.

RAB'BI (Heb., my teacher), a title of respect given by the Jews to their teachers of the law. It is not known earlier than the time of Herod the Great, and is supposed to have taken its rise about the time of the disputes between the rival schools of Hillel and Shammai. In New Testament times the title seems to have been used with a certain amount of freedom, and we find from the Gospels that Jesus was frequently addressed as Rabbi. At a later period the use of the title was restricted to those teachers of the law who had received their appointments in Palestine, the lesser title *Rab*, teacher, being used for those appointed at Babylon or elsewhere. The greater title, *Rabban*, our teacher, or their (*i.e.* Israel's) teacher, was the title of the president of the Sanhedrim from the time of Gamaliel onwards, but this was, with one exception, be-

stowed only upon those who could claim Davidic descent. After the destruction of Jerusalem, Babylon became the chief centre of Judaism, and its leader in that city, the Rosh Galuthā, "head of the captivity," bore also the distinctive title of *Rabban* or *Rabbana*.

In Jewish literature *Rab*, when the title is not followed by an individual name, denotes a celebrated Babylonian teacher, Abba Arikha, famous for learning, ability, and virtue, who died in 247 A.D. *Rabbi*, when not followed by a proper name, denotes Rabbi Jehudah, the Holy, the principal editor of the *MISHNAH*, who flourished in the second century of the Christian era at Liberias. The title of Rabbi is used among the Jews at the present day for the authorized expounders of the law.

RABBIT (*Lepus cuniculus*) is a rodent mammal belonging to the same family and genus as the common HARE. The rabbit differs from the hare by its smaller size and shorter ears, by the fore and hind limbs being more nearly equal, and by the brownish colour of the fur, which becomes white underneath the belly and tail; in addition the black patch at the tips of the ears, which is found in the hare, is wanting in the rabbit. Though now so abundant in Britain as to become in many places a pest to farmers, the rabbit is not a native of this country. Its original home is considered to be the countries bordering the Mediterranean. It has now spread throughout Europe, except in the more northerly and eastern parts. In Australia and New Zealand the rabbits introduced by the colonists have multiplied to such an extent as to constitute a serious nuisance. In its habits the rabbit differs greatly from the hare. It lives usually in large societies in deep burrows which it digs in the ground, the collection of burrows being known as a "rabbit-warren." The young are produced blind, naked, and helpless in a separate burrow, which the female lines with the fur of her own body. The rabbit begins to breed at six months old, and produces from four to eight litters a year, each litter consisting of from three to eight young. They usually remain in their burrows during the day, coming forth in the evening to seek their food. They prefer a sandy soil overgrown with furze, which gives them both protection and food, but they often work great destruction in cultivated fields. In addition to being destroyed as vermin, great numbers are killed for the sake of their flesh and fur.

The rabbit has been domesticated from a very early period, and many varieties have been established, differing largely among themselves and from the wild animal. Some of the domestic breeds exceed greatly in size the wild rabbit, which seldom weighs more than 8 lbs. Remarkable changes, not only in the colour and texture of the fur and the relative development of the ears, but even in the structure of the skull and skeleton, have been induced by artificial selection under domestication. Albinoes with pure white fur and pink eyes are common. The Angora rabbit, which is usually an albino, is remarkable for the length and fineness of its fur. The lop-eared rabbit, which is an old English fancy breed, has drooping ears, often so long as to touch the ground. The silver gray is another breed valued for its fur. The so-called Himalayan rabbit is pure white, except the nose, ears, tail, and feet, which are black.

A large number of rabbits are reared in hutches and exported from Ostend for the London markets.

RABELAIS, FRANÇOIS, one of the most famous of satirical writers, was born near Chinon in Touraine in 1495, the year made memorable by the birth of Luther and of Raffaele. And like Luther, Rabelais was a great reformer, though of a peculiar stamp; like Raffaele, a great painter, though of a far coarser kind. Rabelais was the son of an innkeeper, and this origin seems to have moulded his whole tastes, and coloured his whole destiny. Rabelais having entered a Franciscan monastery at Fontenay-le-Comte in

Poitou, and having received consecration as a priest, began to lay a broad and solid foundation for the most comprehensive knowledge. Astronomy, philosophy, law, grammar, medicine, poetry; Latin, Greek, Hebrew, Italian, Spanish, German, Arabic, were all his to the extent of the knowledge of his day in each. As an accomplished scholar, Rabelais belonged to the past; as a man of the world and of the people to the present; as a bold innovator to the future. This singular priest concealed not his hatred to the priesthood. His brethren envied his learning, and they could not pardon him his crushing scorn, his reckless, audacious buffoonery. The Franciscan monks calumniated and tormented him. To escape from their petty persecutions he was, at the intercession of the powerful patrons whom his wit, joviality, and genius had gained him, permitted by Clement VII. to leave the surly Franciscans, whereupon, in 1524, when nearly forty, he joined the Benedictines at Maillezeais in Poitou, the Bishop of Maillezeais, who was a friend of his, making him a canon of the cathedral. After a while he quitted the Benedictines abruptly. He went to Montpellier to devote himself more completely to medical pursuits. Lectures, public disputations, medical and other treatises, procured him a conspicuous place among the learned, and he was for a time physician to the hospital at Lyons, as well as curate of Souday, close to the great family mansions of new patrons of his, the brothers Du Bellay. Perhaps the daily sight of human pain intensified that sensibility to the grotesque in which he has never been surpassed. It is in the humanest minds that the perception of the grotesque is always the keenest. Rabelais was probably unburdening his heart, as much as he was obeying his riotous fancy, when in 1533 he published the first edition of "Pantagruel, son of Gargantua." The year before (1532) he had collected some of the popular legends about the mystical giant Gargantua, and this gave him the hint for a broadly grotesque tale, under cover of which he might deal with the abuses of the time. It was not till 1535 that his own "Gargantua" appeared. Both books were published under the anagram Alcofribas Nasier. In 1546 the second part of "Pantagruel" appeared, and the work remains a fragment. In 1533 Rabelais had accompanied to Rome the elder Jean du Bellay as that distinguished diplomatist's physician. Jean du Bellay received the cardinal's hat from Paul III., who also absolved Rabelais for his breach of church discipline in leaving the Benedictines. Rabelais could not have had a more active or enlightened protector than the Cardinal Du Bellay, who, though a pliant courtier, was yet zealous for those humanizing influences of which Erasmus had been the mightiest minister. The cardinal first procured for Rabelais in 1536 a place in the Abbey St. Maur, and then in 1545 the curacy of Meudon, near Paris, which he held till his death in 1553. It has been asserted, however, that the year before his death he accepted the curacy of St. Paul's at Paris. The life of Rabelais at Meudon was that of a faithful and most charitable parish priest. Not ascetic himself, he was not inclined to impose on others the bondage of asceticism. Rabelais was able to be a physician to the bodies as well as to the souls of his parishioners. His ministrations of mercy did not interrupt his intercourse with scholars, and wits, and courtiers—did not condemn his pen to idleness. Fresh books were added to the former books, and yet the "Life of Gargantua and of Pantagruel" remained at last only a gigantic fragment, as well as a chaos. It was the good fortune of Rabelais to live in the main undisturbed, and to die in peace, at a time when persecution was as capricious as it was cruel. When Clement Marot, Bonaventure Desperriers, Etienne Doleit, and other victims, vulgar or illustrious, suffered, it is a marvel how Rabelais escaped. Perhaps it was his abounding geniality, still more than the protection of the powerful, which shielded Rabelais from a doom so general and so terrible.

Prodigally gifted, but more genial than gifted, it was always with honest, cordial, overflowing laughter that Rabelais flung his keenest darts, struck his hardest blows; and it is not usually buffoons who are hanged or burned. The work, so original, and yet more monstrous than original, of Rabelais, has been translated into all languages; and indeed, in spite of its extreme grossness in several parts, there are numerous and sufficing reasons why the "Gargantua and Pantagruel" of Rabelais will always maintain its popularity. First of all, it is one of those colossal creations which own no predecessor; it is a miracle of invention. Secondly, the comic pith, if extravagant and brutal, is genuine. Thirdly, the work vividly illustrates the first half of the sixteenth century, alike in its reforming and in its social aspect. Fourthly, it is an integral part of the development and growth of the French language. Fifthly, Rabelais was a man of wisdom and insight. All generations can learn from him lessons of tolerance, and still profounder and diviner lessons. He indicates, to those who read him carefully, what would have sent him to the stake if he had seriously professed. The chapter on the training of Gargantua is one of the classical documents in the theory of education, and that on the Abbey of Theleme is a complete presentation of the Renaissance ideal of life at its best. Since the coarseness (and in fact obscenity) of Rabelais is but the jester's particoloured garment, it is not difficult to prepare Rabelais for the general reader. The ideas of Rabelais beneath his dirty motley are pure and noble, wise and reverent. Pantagruel's discourse on immortality is full of a noble reverence. Coleridge, one of the subtlest critics of our land, in classing Rabelais with Shakspeare and Cervantes, said—"I could write a treatise in praise of the moral elevation of Rabelais which would make the church stare and the conventicle groan, and yet would be truth, and nothing but the truth." It was therefore a good thought of Professor Morley to include a cleansed Rabelais (not altered, except by omissions) among his shilling volumes of the Universal Library (1883). The translation used is the excellent version in fine Jacobean English by Sir Thomas Urquhart of Cromarty (1653).

RABIES. See HYDROPHOBIA.

RA'CA, an ancient Syriac word, signifying folly or emptiness, and employed by the Jews with certain gestures of indignation and contempt.

RACEME (Lat. *racemus*, a bunch of grapes), in botany, a form of INFLORESCENCE in which the flowers spring from a common branchless axis, as in the hyacinth. A bunch of grapes, in spite of the derivation of the term, is not a raceme, but a panicle; good examples of the true raceme are to be found in the red and white currants. See Plate INFLORESCENCE, fig. 6.

RACEMIC or **PARATARTARIC ACID**, an acid isomeric with tartaric acid, from which it differs in its optical properties. It is found chiefly in the crude tartars from the mines of Austria, Hungary, and Italy. It may be formed artificially in various ways, especially by the oxidation by nitric acid of sugar. It accumulates in the mother liquids obtained in the refining of crude tartar in making tartaric acid. The crystals resemble those of tartaric acid, and have the formula $C_4H_6O_6H_2O$. It differs from tartaric acid by precipitating a solution of calcium sulphate, and by the insolubility of the calcium salt in acetic acid. When heated above $200^\circ C.$ (392° Fahr.) it yields the same products as tartaric acid. It is inactive on polarized light, but it may be separated into equal parts of dextro-tartaric and lævo-tartaric acids, which have opposite effects on polarized light. It forms two classes of salts, the acid racemates, having the general formula $C_4H_4M_2O_6$, and the neutral racemates, having the general formula $C_4H_4M_2O_6$. These salts resemble the tartrates, but their solutions exert no action on polarized light. None are of any practical importance.

Racemic acid forms an ether known as ethyl-racemic acid or racemovinic acid ($C_8H_{10}O_6$). It crystallizes in deliquescent prisms, soluble in water and alcohol; and it is monobasic, and forms a number of crystalline salts, having the general formula $C_8H_9MO_6$.

Racemo-carbonic acid or desoxalic acid ($C_8H_8O_6$) is a white crystalline powder, deliquescent and soluble in water and alcohol. It is tribasic, and forms a number of salts having the general formula $C_8H_5M_3O_6$.

RACES, RACING. There are, of course, many foot-races for walkers and runners, and bicycle and tricycle races increase yearly, while trotting matches for horses in harness, long since the popular form of horse racing in America, are finding favour here and there; boat-racing is a highly popular sport both for oarsmen, headed by the great university contest for eights between Oxford and Cambridge on the Thames and by the continuous college races in the universities themselves, and for yachtsmen, headed by the Royal Yacht Club and its several rivals. But in England the word racing, if not specially qualified, is always held to apply to horse racing in the form of ridden horses. These are run at a variety of meetings all over England, the great centres being Newmarket and Doncaster in the north, Epsom, Ascot, and Goodwood in the south; and their long list covers three-quarters of the year, the only months without racing fixtures being December, January, and February. Incessant watchfulness, and occasionally very severe action, is exercised by a powerful association, the Jockey Club, which controls all the great meetings, and succeeds in preserving some reasonable approximation to fairness. The popular interest exceeds even that in the more truly national sport of cricket; the Prince of Wales and others of the royal family, many of the chief members of the aristocracy, the great bankers, and landed gentry breed and run racehorses; at every race vast sums of money change hands; the stakes sometimes rise (as in the Sandown "Eclipse" Stakes, 1886) to over £10,000 for a single contest; horses are entered for the great races almost as soon as they are born; all important newspapers give several columns daily to the record of the betting and other racing intelligence; an illness or the "scratching" (withdrawal from the race) of a "favourite" is spoken of as a national misfortune! and to crown all the Derby Day is actually allowed to close Parliament, which always adjourns over that day, and is observed in London as a very general holiday. The French emperor, Napoleon III., long resident in England and a great admirer of our national characteristics, took considerable pains to acclimatize racing in France. The horses were English in origin and usually English bred, and the jockeys almost always English, but the French took kindly to the sport, and rejoiced with national extravagance when a horse from French stables conquered in the races run in France. The excitement was simply frantic when once, in 1865, a horse from the French stables, Gladiateur, won the blue ribbon of the turf, the Derby. But with the downfall of the second empire the sport has greatly declined, and French fixtures are not now of very great importance.

The following is a sketch of the principal events of the racing year, omitting "gate-money" races, such as Sandown, Croydon, &c. These last often attract fair horses, however, by their liberal stakes, and are well attended in consequence of their proximity to London. Racing proper begins at the close of March at Lincoln over the Curliholme Course (Brocklesby, 5 furlongs, and Lincoln Handicap, 1 mile)—important races because of their revelations of the "form" of horses for the coming year. Then come the Liverpool Steeplechases on the Aintree course, with the Grand National of 4½ miles, monarch of steeplechases. Not far into April Epsom begins its Spring Meeting, containing one of the chief handicaps of the year, the City and Suburban, a great betting race, 1½ mile on the Derby course,

and the Great Metropolitan Stakes, 2½ miles. The following week comes the Newmarket Spring Meeting with the Chaven Stakes for three-year-olds, and at the end of April, also at Newmarket, is run the first of the great three-year-old races, the Two Thousand Guineas, followed by the first important race for fillies, the Thousand Guineas, in the same week. The Chester Cup, run for in May at the quaint old town on the Dee, is the next event, but is now of less importance than formerly. It is succeeded by the principal Kempton Park meeting (private course), the second Newmarket Spring Meeting, and the Manchester May Meeting, with the valuable Manchester Cup, always a heavy betting race. Next comes the great Epsom week, with the famous Derby on the Wednesday, for three-year-olds, 1½ mile, always worth between £1000 and £5000, and the most celebrated race in the world (the sharp bend at Tottenham corner being a never-failing point of excitement, and the countless thousands of Londoners who crowd the hill and the borders of the course being one of the most extraordinary assemblies to be found), and the finest race for fillies, the Oaks, on the Friday, on the same course, the more recent race of the Epsom Grand Prix (nearly £1000) also being run at this meeting on Thursday. This closes the May races. Early in June comes Ascot, the most fashionable of race-meetings, and from its proximity to royal Windsor always honoured with the presence of royalty; the chief races being the Stakes, 2 miles; the Hunt Cup, 1 mile; and the Gold Cup, 2½ miles; and the racing being among the best of the year. Another meeting is held at Newmarket in July, and at the end of July the Sussex Fortnight begins with Goodwood, Brighton, and Lewes meetings. Goodwood is run in the Duke of Richmond's park, and as a somewhat strict surveillance is exercised, it is in many respects the most enjoyable meeting of the year, but the stakes are small and the racing seldom of the very best. (Steward's Cup, ¾ mile; Goodwood Cup, 2½ miles.) Brighton and Lewes meetings carry the season into August, in which month, at York, is also run the Ebor Handicap, 1½ mile. September sees the famous Doncaster Meeting on the Town Moor, with the Great Yorkshire Handicap (St. Leger course, 1½ mile), and the St. Leger Stakes, the second greatest race of the world. Run on a better course than the Derby, and with the interest already attaching to the various great horses of the year, the St. Leger is always a source of keen excitement. With October the Newmarket Autumn races begin, containing the famous long-distance handicap, 2½ miles, the Cesarwitch Stakes, the most renowned race of its kind, and always the occasion of very heavy wagers. Still heavier books are usually made on the last principal race of the year, the shorter handicap, 1½ mile, called the Cambridgeshire, run at the Newmarket second autumn meeting. November sees races at Brighton, Lewes, Liverpool, &c., but its chief race is the Manchester November Handicap at the close of the month, and usually the close of the season also.

RACHEL, MADEMOISELLE, was the theatrical designation of Rachel Felix, the most celebrated tragic actress of modern France. Her father was a Jew pedlar, French by birth, and in the course of her parents' wanderings she was born at the village of Munf, in the canton of Aarau, Switzerland, on the 24th of March, 1821. During her early childhood the family settled for a time at Lyons, where her mother opened an old clothes shop, and Rachel's elder sister Sarah sang in the streets and cafés. About 1830 the Felix family removed to Paris, where the curiosity of an amateur in a café was aroused by Sarah's singing; he inquired into the circumstances of the sisters, and procured the elder one admission into the conservatory of sacred music. Rachel followed her sister, and in time her talent for declamation attracted attention. She made her debut at the Gymnase on the 24th April, 1837; and in spite of her puny and meagre person and gruff voice, she

met with some success. Her real histrionic genius was first discovered by Jules Janin, who, in his feuilleton in the *Journal des Débats* of the 10th September, 1838, proclaimed it to the world, and Rachel's fame was made. She soon took rank as one of the greatest actresses of her time; and the verdict of Paris was confirmed by that of London, where she played in the May of 1841. In 1853 she went to St. Petersburg with a most lucrative engagement, and in 1855 she made a theatrical tour in the United States. There she displayed the first symptoms of the disease of the lungs, of which, after her return home and a journey in search of health to Cairo, she died at Cannes, near Cannes, on the 3rd of January, 1858. Rachel's most thrilling effects were produced by simple means—a tone, a gesture, a look; she had little of the declaimer about her. In her relations with managers she was sordid and litigious; and her private character was, to say the least of it, not all that could be desired.

RACHIS (Gr., the backbone), a term used in botany to express the primary axis of a compound LEAF or of an INFLORESCENCE. From the rachis spring the stalks to which the leaflets or the flowers are attached.

RACINE, JEAN, the greatest French dramatist next to Corneille, was born at Ferts-Milon on the 21st December, 1639. His father held an appointment under government in the salt office, and his mother, Jeanne Seonin, was the daughter of a commissioner of woods and forests in Villers Cotterets. Left an orphan at an early age he was adopted, not, as his son and biographer asserts, by his maternal, but by his paternal grandfather, who sent him for his education to Beauvais and afterwards to Paris, where he was successively a pupil of the Collège d'Harcourt and of the monastic school of Port Royal des Champs. His memory at this early period, according to his biographer, was astonishing. Sophocles and Euripides he knew almost by heart. A Greek romance, with which he was much pleased, his teacher Lancelot twice confiscated, and committed on both occasions the forbidden volume to the flames. Racine purchased a third copy of the book, and after some time, having committed it to memory, handed it to the professor with the remark, "You may burn this too with the others." He was equally well skilled in Latin, which, when he first began to compose in verse, he wrote better than French. Colbert gave him a small royal pension for a poem on the king's marriage in 1660, "*La Nymphé de la Seine*;" and in 1661 a tragedy, the story of which was taken from the favourite Greek romance above alluded to, is said to have been submitted to Molière, who recognized in it promise of high excellence, and proposed to the young poet, as one more suitable for tragedy, the subject which Racine next handled. Racine's "*Thébaïde*" was the result, and was put upon the stage in 1664. In the same year his ode, "*La Renommée aux Muses*" was also rewarded, at a poet's suggestion, by his majesty. Racine's admirer and critic on this occasion was Boileau. The friendship then begun between them was interrupted only by death. During the next ten years Racine produced in rapid succession the great dramas on which his reputation rests. After "*Alexandre*," which is not to be included among his masterpieces, came "*Andromaque*" (1667.) This was the first of his pieces which fairly took hold of the public mind. The sensation which it created on the stage his son compares to that which attended the earlier representations of Corneille's "*Cid*." A comedy ("*Les Plaideurs*"), Racine's only effort in that line, followed; it was praised by Molière, but the public neither praised nor laughed. "*Britannicus*," a noble tragedy, appeared in 1669, and the following year the author of "*Britannicus*," in the full bloom of his powers, and the author of the "*Cid*," in the decline of his faculties, produced each a tragedy, entitled "*Bérénice*." Henriette Anne of England was the instigator of this unequal contest, the risks of which Corneille might surely

have been spared in consideration of the fact that he could gain nothing by success. At any rate, it is hardly surprising if, when his now triumphant rival's "*Bajazet*" was represented in 1672, Corneille should have let the just remark escape him in the theatre, that all the personages of the piece, though Turks in point of costume, were Frenchmen in point of sentiment. "*Mithridate*" appeared in 1673, and shortly after its author was admitted into the Academy. Then came "*Iphigénie*" (1675), and two years afterwards the famous "*Phèdre*." Racine was only in his thirty-eighth year when this latter tragedy appeared, yet he resolved it should be his last. His popularity had made him enemies, of course; its sure and steady increase had formed them into a cabal, whose proceedings were at any rate sufficiently vigorous. In vain Boileau, who now addressed to him his seventh epistle, counselled him to laugh at his enemies. Nothing would satisfy him but to turn Carthusian. His spiritual adviser, however, gave him sensible advice, which he was persuaded to follow. On the 1st June (1677) he espoused Catherine de Rémusat, daughter of an officer of exchequer at Amiens, with whom, though she only knew his dramas by hearing them mentioned in conversation, he enjoyed an unusual degree of matrimonial happiness. To his resolution of writing no more for the stage, Racine, whose religious feelings were now not untinged with asceticism, would probably have adhered to the last, if he had not happily fallen under the influence of Madame de Maintenon, who persuaded him to write a dramatic piece on a scriptural subject, to be performed by the ladies of her foundation of St. Cyr. This was the fine tragedy of "*Esther*," which was performed in 1689 in presence of the court. Two years afterwards "*Athalie*" saw the light under the same auspices, and thus ended the dramatic career of Racine. Had it closed, as he intended, after the appearance of "*Phèdre*," his reputation might not have been any the less, but two of the masterpieces of French literature would not have existed. Shortly after his marriage, Racine, who had written more than one keen pamphlet against Port Royal, was reconciled to the leaders of that celebrated school, and in fact became a decided, though not a bitter Jansenist. For a long period he enjoyed marked favour at court, but later on a sharp remark of Louis XIV., whom Racine held in exaggerated honour, wounded him so keenly that he sank into a state of melancholy, fever supervened, and finally an abscess of the liver carried him off, 21st April, 1699.

RACK (from Old English *wrocan*, to stretch), the name of an instrument of torture, chiefly used for extracting confessions from criminals and suspected persons. It consisted of a large oblong frame of timber, raised a little from the ground, and fitted with rollers at each end. The person to be tortured was stripped and laid in the centre of the frame, his hands and feet being fastened by strong cords passing round the rollers. The latter were then turned round by means of levers, so as to tighten the cords and stretch the limbs of the prisoner, and this operation could be continued until the joints were dislocated. The rack was known to the ancient Romans, and it seems to have been frequently used during the earliest persecutions of the Christians. After the break up of the Roman Empire it was adopted as part of the paraphernalia of justice by all the southern nations of Europe, and it is said to have been introduced to England as early at least as the fifteenth century. It was a favourite implement with the ministers of the Inquisition, who relied greatly on its powers of extracting from a victim anything which his tormentors wished him to say. As late as 1628 a proposal was made to use the rack in England, the occasion being the murder of the Duke of Buckingham by Felton; but the proposal was successfully resisted by the judges, and this barbarous method of obtaining a confession has never been revived.

RACK-RENT, an annual rent of the full value of the tenement, or near it. (Blackstone's Commentaries.) Practically it means the highest rent obtainable by free competition, as opposed to a rent fixed by custom or judicially, &c.

RACCOON (*Procyon*) is a genus of *CARNIVORA*, belonging to the same family (*Procyonidae*) as the coati and kinkajou. The raccoons are nearly allied to the bears (*Ursidae*), agreeing with them in being plantigrade and in the absence of the cæcum or blind process of the intestine. They have forty teeth, two less than the bears, the last upper molar on each side being absent.

The Common Raccoon (*Procyon lotor*) has an extensive range over the upper parts of North America. The body is about 2 feet long exclusive of the tail, stout, and covered with long furry hair of a grayish-brown colour, becoming lighter on the belly. The legs are short, and the feet have five toes armed with strong claws. The head is large, with a sharp prominent snout, oval, slightly pointed ears, and large eyes. The cheeks and a line running down the forehead to the tip of the nose are blackish; the ears, muzzle, and a line over the eyes are whitish. The tail is about 10 inches long, bushy, and marked with alternate bands of black and white. The raccoon sleeps by day, comes from its retreat in the evening, and prowls about in the night in search of roots, fruits, green corn, birds, and insects. It is said to eat merely the brain or suck the blood of such birds as it kills. At low water it frequents the sea-shore to feed on crabs and oysters. It is fond of dipping its food into water before it eats, for which reason Linnæus gave to it the specific name of *lotor*. It climbs trees with facility.

The fur is a valuable article of commerce. The animal is usually taken in traps, but is also hunted by night with dogs, and on these occasions the "coon" displays great activity and address in evading its foes.

The Crab-eating Raccoon (*Procyon cancrivorus*) is a nearly allied South American species, differing chiefly in the shortness of its fur.

RACQUET or **RACKET**, the instrument with which players at racquets or lawn tennis strike the ball; a bat consisting of a network of catgut, strained very tight, in a circle of wood. Racquets is played in a walled court 34 feet wide by $2\frac{1}{2}$, or three times that length. The ball is driven against the head wall above a certain line by the server, standing on the service side, and must be made to rebound on the "hazard" side, where his opponent stands, and beyond a line drawn on the floor parallel to the head wall. The ball, once in play, must be driven against the head wall by each side in turn until one side drops it or returns it in the wrong place, when his opponent scores. [For LAWN TENNIS see that article.] Lawn tennis racquets are much heavier (13 to 15 lbs), and much shorter and stouter in the handle, and wider in the blade than racquets proper.

RADACK and **RALICK** are two chains of coral islands, situated in the Pacific between $5^{\circ} 30'$ and 12° N. lat., and between 167° and 173° E. lon. They are low, but well wooded. The natives belong to the Malay race, but differ in language from the inhabitants of the other islands of the Pacific. They mostly live on the produce of their orchards, and have commodiously built houses. Their larger boats are more than 30 feet long. The sails are made of finely-braided mats, and are managed with considerable art. These islands were discovered in 1816 by Kotzebue, but they have been very little visited.

RADAGAI'SUS was a Scythian chief who led an innumerable horde of barbarians against the Roman territory in the reign of Honorius, when Rome was tottering to its fall. The General Stilicho defeated him near Florence in 408, and he capitulated on terms. He was basely murdered afterwards in cold blood. The fear of a second invasion caused Honorius to recall the Roman legions from Britain in 410.

RADCLIFFE, ANN, who has been called the *Salvator Rosa* of British novelists, was born in London on the 9th of July, 1764. Her parents were respectable tradespeople named Ward; and by descent she was connected with the great surgeon Cheselden, and with the celebrated Dutch family of De Witt. Mrs. Radcliffe, who was endowed with remarkable beauty of person and vivacity of mind, unmarried in 1787, and two years later published her first novel "The Castles of Athlin and Dunbayne." The plot was wild and unnatural, and the book proved a failure. Better success attended the publication in the following year of "The Sicilian." Other novels, and accounts of continental tours which she made, filled her time till 1794, when there appeared her most celebrated performance—"The Mysteries of Udolpho"—for which she was paid £500, then a very high price for a novel. In this work she indulges freely her taste for the romantic and the terrible, introducing mountain forests and lakes, obscure solitudes, ruined castles, wild banditti, and the shadowy forms of supernatural visitants. In 1797 Mrs. Radcliffe made her last appearance in fiction with "The Italian," for which she received £800. The Inquisition, the cowed monk, the dungeon, and the rack form the characteristic features of this powerfully written novel. This, and its better remembered predecessor, have earned Mrs. Radcliffe a not very desirable kind of fame. Many who sneer at her horrors, now so tame, have not read the books they deride, and her very success deprives Mrs. Radcliffe of the esteem she really deserves. For the last twenty-six years of her life Mrs. Radcliffe lived in retirement, witnessing the triumphs of those who in some important particulars were her literary disciples—Scott and Byron. She died of spasmodic asthma on the 7th of February, 1823, and was buried in the chapel at Baywater, attached to St. George's, Hanover Square.

RADCLIFFE, JOHN, a celebrated physician, was born at Wakefield, in Yorkshire, in 1650. He studied at University College, Oxford, which he left to become a fellow of Lincoln in 1672. He took the degree of M.B. in 1675, and practised in the university. Dr. Marshall, the rector of Lincoln, having taken offence at some witticisms uttered by Radcliffe, opposed his application for a faculty place in the college, which would have enabled him to retain his fellowship without taking holy orders. He therefore resigned his fellowship, took his doctor's degree on 5th July, 1682, and removed to London in 1684. Aided by his previous reputation Radcliffe at once stepped into large and lucrative practice. In 1686 he was appointed physician to the Princess Anne of Denmark, and in the following year he was created a fellow of the College of Physicians by the charter of King James II. After the Revolution Radcliffe was constantly employed at court, although he refused the appointment of permanent physician to King William. He afterwards lost the favour of the Princess Anne of Denmark, by refusing to attend her when summoned, saying "that her highness's distemper was nothing but the vapours, and she was in as good a state of health as any woman breathing, could she but believe it." He was equally uncourtly in a reply he made to King William. In 1699 the king, after his return from Holland, sent for Radcliffe, and showing him his swollen ankles, which contrasted with the emaciated condition of the rest of his body, said—"What think you of these?" "Why, truly," replied Radcliffe, "I would not have your majesty's two legs for your three kingdoms." The king never forgave this answer. When Queen Anne came to the throne it was the wish of Earl Godolphin that Radcliffe should be reinstated as her first physician. But the queen would not hear of it, alleging that he would send her word, as he had before, that her illnesses were nothing but the vapours. In 1713 he was elected M.P. for the town of Buckingham. In the last illness of the queen he was summoned to attend her, but he sent an answer that he had taken physic, and could not come.

Radcliffe was much censured for not visiting the queen in her last extremity, and it is said that a dread of the popular indignation hastened his own death, which took place on 1st November, 1714. Radcliffe, although extremely fond of money, did many generous and charitable acts during his lifetime. He has immortalized his name by the disposal of the large property he had amassed. He left his estate in Yorkshire to University College, Oxford, in trust for the foundation of two medical travelling fellowships; he left also £5000 for the enlargement of the building of the college; £40,000 for building a library at Oxford, with £150 per annum to the librarian, and £100 per annum for the purchase of books. He also left £500 a year to St. Bartholomew's Hospital in London towards "mending their diet," and £100 to buy linen. His estates in Buckinghamshire, Northamptonshire, and Surrey were left in trust for charitable purposes. From these funds the Radcliffe Infirmary and Observatory at Oxford were built. Dr. Radcliffe is buried at St. Mary's Church, Oxford.

RADCLIFFE LIBRARY, &c. (Oxford), founded by Dr. John Radcliffe [see preceding article], stands in the centre of Radcliffe Square, a handsome rotunda 85 feet high, the dome supported on arcades; it was built 1737-47, from the design of Gibbs, who at his death left his library to enrich its collection. Other donors were equally munificent, and the library became rich in scientific, medical, legal, and architectural works, to which the trustees added a fine collection of Oriental MSS. by purchase. In 1861 the scientific portions of the library were removed to the museum then erected, and the great room under the dome, thus cleared, was connected with the famous Bodleian Library as a reading-room, for which purpose it is open from 9 a.m. to 10 p.m.

RADETZKY DE RADETZ, JOSEPH WENZEL, COUNT, a celebrated Austrian field-marshal, was born in 1766, of a noble family in Bohemia. He entered the Austrian army in 1784, served in the campaigns against the Turks in 1788-89, and in those against the French Revolution in 1792-95, and commanded the fifth army corps in the war of 1809. At the peace, having been made chief of the staff, he devoted himself for some years to reorganizing the Austrian army; and is said to have planned the operations which inflicted on Napoleon the terrible defeat of Leipzig. In 1831 Radetzky was appointed to the command of the Austrian army in Italy, and in 1836 he was made a field-marshal. On the 18th of March, 1848, insurrection broke out at Milan. After several days of street-fighting Radetzky, seeing that Italy was "up," and that the Piedmontese army was in motion, prudently evacuated Milan and retreated to Vienna, which in June was threatened by Charles Albert. After several movements and engagements, varying in their results, Radetzky, who had resumed the offensive, defeated the Sardinians at Custoza (25th July), re-entered Milan (6th August), and granted an armistice to Charles Albert. The armistice ceased in March, when Radetzky crossed the Ticino, defeated the Piedmontese in several engagements, and by gaining the crowning victory of Novara (23rd March, 1849), concluded a peace which brought with it the abdication of Charles Albert and the restoration of the Austrian rule in Italy. Radetzky was now appointed governor-general of Austrian Italy, and he was past ninety when, in February, 1857, he obtained permission to retire into private life. He died at Milan, full of years and honours, on the 5th of January, 1858.

RADIATION OF HEAT is the propagation of heat from a hot body, either through vacuum or a transparent medium. See HEAT.

The intensity of heat thus emitted from a point of radiation is obviously the same at equal distances from the point; and at unequal distances it is inversely proportional to the squares of the distances. The radiant heat falling

upon the surfaces of any bodies in the vicinity of that from which they emanate is, according to the nature of those bodies, absorbed in them, or transmitted through them, or again may be reflected from them; and in the two last cases appears to suffer modifications analogous to those which, in like circumstances, take place in light.

MM. Saussure and Pictet made experiments on the radiation of heat by means of two concave mirrors. But the subject was more fully investigated by Professor (Sir John) Leslie at the beginning of the present century, by means of a simple and ingenious apparatus. He placed a tin canister filled with hot water in the focus of a parabolic mirror of the same metal, and a differential thermometer in the focus of another such mirror, which was placed opposite to it. The four sides of the canister were covered with the substances whose radiating powers were required. When three of the sides were covered respectively with lamp-black, paper, and ground glass, and then turned so as to radiate directly on one speculum, the heat reflected by the other raised the thermometer to 100, 98, and 90 degrees; but when the fourth side, which was uncovered, was similarly directed, the thermometer fell to 12 degrees. Thus it appears that polished metallic substances are bad radiators, which may be attributed to the internal reflection of the heat from their surfaces.

Professor Leslie also repeated the experiments of Pictet for determining what was called the radiation of cold; and filling his canister with ice or snow, he found that the cold apparently emitted from the varnished side was the greatest, and that from the polished side the least; he observed also that the cold, like the radiant heat, varied with changes in the absorbent power of the thermometer and of the surface of the mirror. These circumstances, which seemed at one time to favour the opinion that cold had a positive existence like heat, have received an explanation from M. Prevost of Geneva. This philosopher observes that a mass of ice or snow may send out radiant heat less in abundance than that which is emitted from other bodies in its vicinity; and this comparatively small quantity of heat, when reflected from one mirror to the other, and from the surface of the latter to the focus, may there produce the effect of absolute cold, by causing the thermometer to send out radiant heat to the ice, and thus render the mercury in it lower than it would otherwise be.

Experiments made by Count Rumford, soon after the publication of Leslie's work, produced nearly the same results as the latter had obtained; and the count draws from them several useful conclusions. He observes that if we would confine heated substances, solid or fluid, in a vessel, the surface of the latter should be highly polished (an argument in favour of silver teapots); on the other hand, if the object be to cool the substances, the surface should be painted or covered with a soft coating which is not metallic. Also, in warming apartments by steam, the intention being to promote radiation as much as possible, the tubes conveying the steam should be unpolished or painted.

The subject of the refrangibility of radiant heat was first examined by Sir William Herschel; the latest discoveries in this branch of the subject are given in the article HEAT SPECTRUM.

According to Tyndall's experiments, aqueous vapour exerts a powerful absorptive action on heat of low refrangibility; and it is inferred that, weight for weight, aqueous vapour transcends all others in absorptive power. Therefore, as the aqueous vapour of the atmosphere absorbs a good deal of dark heat, while it allows the solar rays to pass with little or no diminution, the result to our earth is important; for while the sun's rays act with full effect in heating the earth, the "dark" heat cannot readily radiate back through the aqueous vapour into space. Tyndall says, "Remove for a single summer

night the aqueous vapour from the air which overspreads this country, and you would assuredly destroy every plant capable of being destroyed by a freezing temperature." (See SUN; also "Heat a Mode of Motion," by Professor Tyndall, London, 1870; "Watt's Dictionary of Chemistry," 1872.)

RAD'ICAL (Lat. *radicalis*, fundamental, from *radix*, root), a political term which first came into use in England about 1830, to designate the advanced members of the Liberal party. It was originally *radical reformer*, but *radical* and *radicalism* have long been the terms chiefly in use for describing the advanced Liberals and their principles in Great Britain. For a considerable period the term was supposed to convey a reproach, but it is now readily accepted and proudly advanced as a party designation, though, like certain other political names, its meaning varies considerably, and is not always easy to define. The word has passed beyond the confines of England during the present generation, and it has become familiar to foreign politicians as a convenient name for the members of the advanced schools.

RAD'ICLE or **RAD'ICAL**, a term applied in chemistry to a group of elements common to a series of allied compounds, and which is not decomposed or broken up by any reactions or processes that transform these compounds one into the other.

RADIOMETER, an instrument invented by Mr. Crookes, and originally supposed by him to be capable of exhibiting and measuring the direct mechanical action of light. In the course of weighings made by Mr. Crookes to determine the atomic weight of the new metal thallium, he noticed that when a small light body is delicately suspended in the most perfect vacuum that can be produced, it is repelled by radiant heat or light, although the same body suspended in the same vessel, from which the air has not been exhausted, seems attracted by the same radiant force. This was found in the first instance from a bar of pith delicately suspended by a fibre of cocoon silk. The transition was obvious to an apparatus in which the arms, instead of being suspended by a fibre, should rest on a point, so as to be free to rotate continuously in either direction; and thus originated the "radiometer"—the name given to it by Mr. Crookes being intended to express its action as a measurer of the mechanical power directly exerted by that radiant energy, which had been previously known to manifest itself only under the forms of light, heat, and actinism (or chemical agency). As now constructed, the radiometer consists of four arms suspended on a steel point resting on a cup, so that it may revolve horizontally. To the extremity of each arm is fastened a thin disc of pith about the size of a threepenny piece, lampblack on one side, and with a bright metal face on the other, the black surfaces facing the same way. The whole is inclosed in a glass globe, which is then exhausted of air to the highest possible point, and hermetically sealed. When exposed to light the arms commence to revolve, and the speed depends on the amount of light, whether artificial or from the sun's rays. Without other perceptible agency than the general light of an apartment, the cross slowly rotates horizontally in the direction of the white sides of the discs. When a candle is brought within a foot or so of the globe, the rotation becomes much quicker. When the candle is approximated to within two or three inches of the globe, the cross spins rapidly round; and when a piece of magnesium wire is burnt close to it the rapidity of the rotation becomes so great that the discs can no longer be separately distinguished.

It was scarcely surprising that an impression should at once prevail that the direct mechanical action of light had been discovered; and the ingenious inventor of the radio-

meter proceeded to calculate the exact force or weight of the light required to move the discs, and to deduce from this the amount of pressure which light exerts on the whole surface of the earth. Mr. Crookes estimated this at 3,000,000,000 tons; but the calculation was premature, as it was subsequently demonstrated that the motion was due to the pressure on the vanes of the molecules of air or gas contained in the imperfect vacuum—the globe above mentioned.

RAD'ISH (*Raphanus sativus*) This plant has been cultivated in this country for upwards of 300 years, and has given rise to numerous varieties, such as the "long-rooted" and "turnip-rooted" radishes. They are also denominated spring, summer, autumn, or winter radishes, according to the season in which the respective sorts are found best adapted for use.

If the early white turnip radish be sown in August it will come into use in autumn. The principal sowings should, however, be made in January and February, and successively till May. The winter varieties require to be sown in July. In cold frosty weather the beds should be protected by straw, as is commonly practised, or by such other efficient means as may be at command. The covering should be always dispensed with when the days are fine; but it ought to be replaced before the cold of night ensues. Radish seed-pods are sometimes pickled while tender, and may then be used for the same purpose as capers when the latter cannot be obtained. The root possesses diuretic, demulcent, and stimulant properties.

De Candolle, in his "Origin of Cultivated Plants," comes to the conclusion that the radish is a native of the Caucasian region, from which its culture spread east and west; it has certainly been cultivated in China for a very long period. Radishes are figured on the Egyptian tombs, and both Greeks and Romans thought very highly of this vegetable. Some botanists consider the radish to be merely a cultivated form of the wild radish (*Raphanus raphanistrum*).

RA'DIUS ("a ray," "the spoke of a wheel") means the line drawn from a point considered as a centre or pole, to any point of a curve. In a circle a radius is any line drawn from the centre to the circumference, and the peculiarity of the circle is that all its radii are equal.



Radius.

Radius vector.

Radius vector is the name of the line joining a pole to a point, in the method of polar co-ordinates. Given A the pole, AB the direction of the axis or initial line, AP the radius vector, and $\angle BAP$ the vectorial angle, and the position of the point P is determined. The radius vector of a planet is the line joining it with the sun; and as it shortens the planet increases its pace, so precisely that the radius vector sweeps out equal areas in equal times, although the sun is almost at one of the foci of the ellipse. This is the second of Kepler's famous laws.

RAD'NORSHIRE, a county of North Wales, of an irregular form, bounded N. by Montgomeryshire and Shropshire, east and south-east by Herefordshire, south and south-west by Brecknockshire, and west by Cardiganshire. Its greatest length, east to west, is 33 miles. Its greatest breadth, north to south, is 30 miles. The area is 432

square miles. At the census of 1881 the inhabitants numbered 23,528.

Surface, Hydrography, &c.—Radnorshire is a mountainous county. The highest range is that of Radnor Forest, one portion of which attains the height of 2163 feet above the level of the sea. This wild tract produces nothing but moss and heath. There are some hills of considerable height in the other parts of Radnorshire. The rivers and streams nearly all empty themselves into the Wye and its tributaries.

The Wye enters the county on the north-west, at a distance of about 18 miles from its source on Plynlimmon. After passing Rhayader it flows S.E. and then east, separating Radnorshire from Brecknockshire, after which it flows north for a short distance by the side of Herefordshire, into which county it proceeds. The Elan joins the Wye on the right bank, a short distance below the town of Rhayader. The Ithon flows south, and drains the central portion of the county; and before its junction with the Wye, on the left bank of that river, 7 miles above the town of Builth, it becomes a stream of considerable size. Its entire course is 30 miles. The Elan and Ithon are the only two rivers which exclusively belong to Radnorshire, but the Lug and the Teme have a part of their course in it. The smaller streams are the Somerget, Edw, Marteg, Clywedog, Arrow, and Bachwy. There are a few lakes, but they are all unimportant.

Geological Structure.—The principal portion of the shire is composed of the strata forming the Silurian system; but on the west and north-west side the upper beds of the older rocks, composing the Cambrian system, make their appearance. These rocks comprise perhaps one-fourth of the whole area, having in their extreme western and north-western limits a slaty character, which towards the interior or east is gradually changed to quartzose gneiss. The Ithon forms almost exactly the line of junction of the Cambrian rocks with those of the Silurian system; the latter, however, encroach somewhat on the west of the Ithon as it approaches the Wye.

Soil and Agriculture.—A great portion of the county consists of commons, bogs, and moorland, and is therefore comparatively useless for agricultural purposes. On the borders of Salop and Hereford, and in the valley of the Wye, there are some fertile tracts of good land. Oats, barley, and potatoes are the principal crops. The mountains and commons are occupied as sheep walks, and the stocks are larger than in any other Welsh county. The cattle are principally of the famous Hereford breed. The sheep are chiefly of the small local kind, but have been modified in some parts by imported breeds. Small Welsh ponies are extensively reared in the county.

The manufactures of Radnorshire consist only of such articles as are required for local use, and there are no minerals. The county is supplied with railway accommodation by means of the Central and Mid Wales, and the Hereford, Hay, and Brecon lines.

Radnorshire is divided into six hundreds. It is in the diocese of Hereford and St. David's, and in the South Wales Circuit, the assizes being held at Presteign. The county returns one member to Parliament.

History.—Radnorshire originally formed part of the territory inhabited by the Silures. After its subjugation and ultimate abandonment by the Romans, it was included in one of the petty principalities into which Wales was divided; and its history is naturally merged in that of Wales. It became the prey of the Norman adventurers, who obtained a settlement in Herefordshire and Brecknockshire after the Conquest. In the reign of Henry VIII. Radnor was formed into a county.

Offa's Dyke enters Radnorshire on the north at Knighton, and, running south, crosses into Herefordshire at Berva Bank, a steep hill between Presteign and New Radnor.

VOL. XI.

The only monastic establishment in the county seems to have been that of Abbey Cwm Hir, or the Abbey of the White Monks, which is romantically situated in a narrow valley surrounded by high hills in the north-west portion of the county, to the left of the road leading from Llandewy to Newtown.

RADNOR or NEW RADNOR, or Maes-tyfod Newydd, formerly the capital of the above county, but now degenerated into a village, is about 9 miles W.S.W. from Presteign, and 7 miles from the Kington station on the Leominster and Kington Railway, which is 171 miles from London. In the centre of the town is a handsome Gothic cross, erected in 1864 as a memorial to Sir G. C. Lewis. It is octagonal, rises in three stages, and is crowned by a spire. On the lowest stage is a handsome bust of Sir G. C. Lewis, who once represented it in Parliament. It was merged in the county in 1885. The population in 1881 was 2005.

RADNOR OR OLD RADNOR, or Maes-tyfod Hen, called also Pen y-Craig, or "the summit of a rock," stands on an elevated situation, about 3 miles south-east from New Radnor, and $3\frac{1}{2}$ from the Kington station. The church is prettily situated, and contains a curiously-carved wooden screen. The surrounding scenery is exceedingly interesting and beautiful. Part of the parish is in Herefordshire.

RAFF, JOSEPH JOACHIM, a distinguished German composer, who failed but a little from reaching the first rank, was born near Zurich in 1822, and educated in Wirtemberg. He was at first a schoolmaster, but pursued his musical studies with such enthusiasm and success, that in 1843 Mendelssohn took him up and introduced him to the great publishers, Breitkopf & Härtel of Leipzig. Later on Liszt also befriended him, and he went on a concert tour with that generous friend to all youthful genius. Still later Von Bülow lent him a helping hand. Raff was often in considerable necessity, and this pressed him to produce too rapidly for his fame. Much indeed was merely "written to sell," but the "Lamento" and "Im Walde" symphonies, his pianoforte concerto, and suite for violin and orchestra, and many other works of the highest excellence and most curious learning, show what he might have accomplished under brighter auspices. His numbered works reach 212, and several important works remain unnumbered. Raff was appointed director of the Frankfurt Conservatoire in 1877, a post he held till his death, in 1884.

RAFFAELLE, or in the older English spelling *Raphael* (Raffaello Santi or Sanzio), the great painter, called by his countrymen *Il Divino*, was born at Urbino, the 6th April, 1483, the same year in which Luther and Rabelais were born. He was the only son of Giovanni Santi, an excellent painter of the Umbrian school, who brought up his son to his own profession; but, as he died in 1494, the boy was, in 1495, placed by his uncles, Simone Ciarla and Bartolommeo Santi, with the celebrated Pietro Vannucci (Perugino) at Perugia. Raffaello lost his mother when he was only eight years old. He spent some years with Perugino, and in 1502 we find him employed at Siena in assisting Pinturicchio, an older pupil of Perugino. Raffaello had, however, little to do with the execution of Pinturicchio's famous frescos in the library at Siena.

In 1504, when he was just of age, Raffaello painted the well-known "Sposalizio" (marriage of the Virgin), the chief ornament of the Brera gallery at Milan. Everybody remembers the circular temple behind and above the wedding group, and the suitor in front, a dandy of the period, who is represented stooping to break his barren wand, while the chosen Joseph with his right hand puts a ring on the bride's finger, and holds in his left his more favoured wand, which, according to the legend, has blossomed into a lily.

Towards the end of this same year Raffaello paid his first, and for him momentous, visit to Florence, where he was

warmly received by the Gonfaloniere Pier Soderini, and by most of that marvellous crowd of immortals who then made Florence the chief artistic centre of the world. With astonishing rapidity Raffaele shook off the mannerisms of Perugina, and learnt from one great artist after another some special quality of colour, vigour of drawing, or grace of composition, in which each happened to excel. From Signorelli and Michelangelo he learnt the importance of precision of line and a thorough knowledge of the human form; from Fra Bartolommeo nobility of composition and skilful treatment of drapery in dignified folds. Nor was Raffaele a pupil of the living only; he closely studied the Carmine frescoes of Masaccio and Masolino, and the sculptured reliefs of Ghiberti and Donatello. Florence was Raffaele's headquarters until 1509, when he was invited to Rome by Pope Julius II., through the recommendations of his fellow townsman (possibly his uncle) Bramante, then all-powerful in matters of art at Rome. Up to this time Raffaele had painted much in the taste of Perugino and the Umbrian school generally, though he had much enlarged his manner of drawing before he left Florence. The famous cartoon of Pisa, exhibited at Florence by Michelangelo in 1506, could not fail to have much influence on so impressible a mind as that of the young painter of Urbino. Notable works of this period, besides the "Sposalizio" at the Brera (1504), are the Madonna del Baldacchino, and that "del Cardellino" at Florence; the "Entombment," in the Borghese gallery at Rome, painted in 1507; the Belle Jardinière Madonna of the Louvre; and the "St. Catherine" in the National Gallery in London, painted at the same time. At Rome Raffaele again met Michelangelo, against whom, in the strife for the Pope's favour, he was pitted by Bramante. The great work of Raffaele in Rome was the decoration of the dwelling rooms of the popes in the Vatican palace, now, through these very frescoes, world-renowned as the Vatican "Stanze." They consist of four principal rooms, and are generally designated after the most remarkable frescoes which they contain, as the "Sala di Costantino," the "Stanza dell' Eliodoro," the "Stanza dell' Incendio." The "Hall of Constantine," the first entered, is the last that was painted, and it was not completed until after Raffaele's death (1523), by his principal scholars, Giulio Romano and Gianfrancesco Penni. It contains the great battle between the emperors Constantine and Maxentius. The second chamber, the "Stanza della Segnatura" (of the signature), was the first painted, and Raffaele was here engaged about three years (1509-11). It contains the "Theology," or so-called *Disputa* on the nature of the sacrament of the Lord's supper (1509); the "Philosophy, or the School of Athens" (1511); with detached figures of "Poetry" and "Jurisprudence." The first two large frescoes show the painter's gradual progress to his own second or enlarged manner. The "Theology" is in his Florentine taste; the "Philosophy" in his Roman, showing some influence of the antique. It was, however, in the next apartment, in the "Stanza dell' Eliodoro," that Raffaele first entirely developed his grand manner, in the "Expulsion of Heliodorus from the Temple of Jerusalem," a subject taken from the Book of Maccabees. This is the chief fresco of this room, and was painted in 1512, at the same time that Michelangelo completed his vast series of frescoes on the ceiling of the Sistine chapel; and as Raffaele saw these works in progress, his own great improvement in style is generally attributed to the example of the great Florentine painter. In this room are also the "Mass of Bolsena," the "Attila," and "Peter delivered from Prison," all completed by 1514. The works of the fourth room, the "Stanza dell' Incendio," in which the most remarkable picture is the arresting the fire of the Borgo, a suburb of Rome, are inferior to the rest; they were painted in 1517, and were executed chiefly by the painter's scholars. From this time Raffaele was too much engaged on other works

to bestow much of his own time on the Stanze, and, as observed above, the first room was not completed until after his death. All these great frescoes, which unfortunately suffered through neglect and ill-treatment in the seventeenth century, are among the triumphs of modern art, and are monumental works, notwithstanding the difficulties thrown in the painter's way from the unsuitable character of the walls, and the general meanness of the rooms. All are grand in character, in dramatic truth of composition, and some are, compared with ordinary frescoes, magnificent even in colour. Of this time is that magnificent portrait of Pope Julius II., of which the best copy is at the Pitti Palace in Florence, but a splendid replica, believed to be by Raffaele himself, is one of the glories of our own national collection. Leo X. succeeded Julius II. in 1513, after the completion of the "Heliodorus," which was painted for Julius, and is the grandest of all Raffaele's frescoes. The slow progress of these works from this time is chiefly owing to the numerous commissions with which Leo himself and other patrons almost overwhelmed Raffaele. He excused from that time—besides many Madonnas and Holy Families, portraits, and other less important works—the series of the Vatican loggie (external galleries for promenade), known as "Raffaele's Bible," the "St. Cecilia" at Bologna; the Madonna di San Sisto at Dresden (1515); the "Spasimo" (Christ bearing his cross, formerly in the Church of St. Marie del Spasimo at Palermo, now at Madrid); the "Galatea," and other frescoes of the Farnesina; and the magnificent series of cartoons for tapestry hangings for the Vatican, of which seven, now at Hampton Court, were bought by Charles I. at the suggestion of Rubens. And from the year 1514 he was the superintending architect of the new church of St. Peter's, succeeding Bramante in that office. It was doubtless owing to his multifarious occupations that his brilliant career was so prematurely terminated. On one occasion (in March, 1520), when engaged at the Farnesina, he was suddenly summoned by Leo X. to the Vatican, and in the haste to meet the Pope overhated himself; and in this state had his interview with his holiness and caught a cold and fever, from which he never recovered. He died on his birthday, the 6th of April following, having exactly completed his thirty-seventh year; and as he died on Good Friday, Vasari, and others after him, overlooking the fact of Good Friday being a movable feast, were led into the mistake that he was born also on Good Friday, which has in consequence become a popular error. His body lay in state, with his last work, the "Transfiguration" (unfinished) at his head, and was buried with great pomp, in the Pantheon or Santa Maria della Rotonda at Rome. A skull was long shown in the academy of St. Luke as that of Raffaele, but in 1823 his tomb was opened, and the skeleton, with all the teeth, found entire. A mould was taken from the skull, and the tomb was closed up again.

Raffaele was of a sallow complexion, had brown eyes, was slight in form, and was about 5 feet 8 inches in height. There are several portraits of him extant, from his childhood upwards. He was never married, but was engaged to Maria Bibiena, niece of the cardinal of that name; she died before him. He left property to the value of 16,000 ducats, a large fortune at that time; and he had two houses at Rome, a fine mansion in the city, and a small villa outside the walls. The last was inhabited by his mistress, the beautiful baker's daughter, La Fornarina (*Fornaro* is the Italian for a baker), to whom Raffaele bequeathed an independence. His painting materials and works of art he bequeathed to his two favourite scholars, Gianfrancesco Penni and Giulio Romano, then both young men, on condition of completing his unfinished works. In 1527 his great and numerous school was dispersed. Giulio Romano established his style at Mantua, and Penni carried it to Naples; Polidoro da Caravaggio spread it to Sicily;

Garofalo early introduced it into Ferrara, and Pierino del Vaga founded a school upon its principles at Genoa.

Throughout the last three centuries and a half no painter has been so universally popular as Raffaele, or has so steadily maintained a pre-eminent reputation throughout the many changes in taste that have taken place since the fatal 6th of April, 1520, when all Rome crowded to pay their last tribute of respect to the corpse of the divine painter, laid out in state by the side of his unfinished "Transfiguration." This constancy of admiration which has been felt for Raffaele is due to many causes. In the first place, to the remarkable way in which he combined the highest merit as a draughtsman, colourist, and master of graceful composition; secondly, to the wide range of his subjects and technical methods; and lastly, perhaps most of all, to the extraordinary varieties of his style. In his earliest works Raffaele came very near to the simple directness and highly religious spirit of the older Perugians, of whom Fiorenzo di Lorenzo was the chief. In his middle period he worked in the more developed style of the great Florentines of the end of the fifteenth century; while, toward the end of his short life, Raffaele was the leader of the new—almost pagan—style which, in a few years, was doomed to give the death-blow to all that was most valuable and lasting in the art of Italy. Without the help of historical evidence, who would guess that the "Sposalizio" of the Brera, the Madonna del Baldacchino of the Pitti, and the "Transfiguration" of the Vatican could possibly be the work of the same hand? In all there are about 900 works attributed to the master upon good evidence, of which 300 are finished pictures, an astonishing number when we consider they were all painted between 1501 and 1520, only sixteen years in all! But works executed between 1517 and 1520 are looked on with much suspicion, as far as their authenticity is concerned, on account of the master's growing reliance upon his studies of the antique, and still more upon the assistance of his talented pupil and close imitator, Giulio Romano. For instance, if we turn to the "Galatea" (1519), the great Farnesina fresco, and a crowning instance of the influence of Raffaele's studies of the antique, we see that, though full of excellence, it was not executed with the nicety of style and treatment which would necessarily come of uninterrupted application. Its various parts recall the master's early Florentine bias, his subsequent study from the antique, and the final employment of Giulio Romano; and of these three circumstances the third is the most strongly marked, and its force accounts for the discrepancies of style and inequalities of taste and care in all these later works. A very powerful factor was the overwork to which the master had long been subject. It is not surprising to find among the incidents of Raffaele's decadence the astonishing intrigue in which Leo X. and Agostino Chigi were concerned when they caused the painter's mistress to be carried off, and only returned to him on his promise, not merely to devote himself more assiduously to the completion of the Stanza of Heliodorus, but to undertake with new energy the decorations of Agostino's palace of the Farnesina, and especially to devote himself to the "Galatea." We owe this edifying story to Fabio Chigi (descendant of Agostino), who became himself, in 1655, Alexander VII.

Raffaele's masterpiece of the easel-pictures is unquestionably the far-famed Madonna di San Sisto of the Dresden gallery, superior not only in beauty, but interest also, to the "Transfiguration," in that it was executed entirely by the master's own hand. Painted in 1515 at the summit of his power for the monks of San Sisto at Piacenza (whence its popular name), it was sold by them in the middle of the eighteenth century to Augustus of Saxony for about £9000, and it now hangs in the Dresden gallery. Considering the enormous sum (£70,000) paid in 1884 for the vastly inferior Ansdei Madonna, now

in our National Gallery, one is almost afraid to guess at the price that the Madonna di San Sisto, would realize to-day. The Madonna di San Sisto shows the Virgin standing on clouds, her veil pushed from her face, and floating gracefully around her form, the divine infant smiling in her arms. A green silk curtain, partly withdrawn, reveals the vision, at which two exquisitely lovely cherubs gaze from beneath, leaning on a low parapet. In the foreground are two figures, one that of Pope Sixtus, and the other that of St. Barbara. The Ansdei Madonna of the National Gallery, purchased from the Blenheim collection of the Duke of Marlborough in 1881, takes its name from the chapel of St. Nicholas of Bari, belonging to the Ansdei family, in the Church of San Fiorenzo at Perugia, for which it was painted, or at any rate was begun, in 1505, the year after the "Sposalizio." It represents the mother and child on a throne, St. Nicholas of Bari on one side, and St. John the Baptist on the other. Though the picture is only 8 feet high, the beholder, on looking at it, undergoes the illusion frequently noticed in the case of works of the rarest excellence, and imagines that the figures are of the size of life. It is painted on a perfectly white and smooth panel of poplar, which gives a brilliant ground, on which the pigments lose none of their splendour. It possesses all the noble vigour of Perugino's colour—with the best manifestations of which it assorts perfectly—and is instinct with a deeper glow than his; while a purity of light and harmonies of tone finer than Vanucci's abound in it, which, combined with the peculiar colouration, produce a noble and delicate chiaroscuro, such as only the choicest paintings exhibit. The ivory-like under-tints of the somewhat unsubstantial carnations, and the nearly faultless draughtsmanship, give a certain spirituality and an unearthly charm, which is irresistible. In the face of the Virgin we recognize a stage of Raffaele's development between the Peruginian type and the more animated and womanly character of his Florentine period. The forms of the figures are rounder and less statuesque.

All previous "lives" and accounts of Raffaele are superseded by the excellent work of Messrs. Crowe and Cavalcaselle, the second and final volume of which was issued in 1885 (London, Murray), and which is one of the most careful and authoritative works in the history of painting. A more interestingly written book is the French Muntz's "Life of Raffaele" (second edition, 1886), illustrated magnificently with Brann's photographic reproductions; and a safer book is the German Springer's "Raffaele and Michelangelo," also well illustrated: but the English work is clearly the best. It fitly commemorates the 400th year of Raffaele's birth (1883), to which circumstance it possibly owes its inception. The centenary was celebrated at Rome on the 6th of April, 1883, in an impressive manner, all the many artistic associations of Rome, composed of every nationality in the world, taking part in the great procession to the Capitol, where a fine bronze bust of the painter was unveiled in the hall of the Horatii and Curatii, and crowned with laurel by the officials of the Academy of St. Luke.

RAFFLES, SIR THOMAS STAMFORD, a distinguished traveller, naturalist, and colonial governor, the son of a captain in the West India trade, was born at sea, off Jamaica, 5th July, 1781. At the age of fifteen he was placed as an assistant clerk in the India House. In this situation he showed much talent and industry, and in 1805 was appointed under-secretary to the new government formed by the late East India Company at Pulo-Penang, or Prince of Wales Island. His acquirements in the Malay and other Eastern languages rendered him so useful to the government that he was promoted to be secretary.

The expedition against Batavia, in 1811, having been proposed by Raffles, and successfully carried out by the British government, he was appointed lieutenant-governor of Java and its dependencies. In his administration he

evinced great energy of character, but became an object of jealousy to some of his colleagues, and was recalled in 1816. On his return to England he published his "History of Java" (two vols. 4to).

In 1818 he was appointed lieutenant-governor of Fort Marlborough, the seat of the English government at Bencool, on the island of Sumatra, where he effected many improvements. In 1820 he sent home a large collection of preserved animals, which are now in the museum of the London Zoological Society. Ill health compelled him to return to England in 1821. In consequence of a fire on board the ship by which Sir Stamford was about to sail, he lost the greatest part of his extensive collection of animals and plants, as well as many volumes of manuscripts and drawings relative to the civil and natural history of nearly every island in the Malayan Archipelago; besides this, which might be considered as a public misfortune, his own pecuniary loss amounted to upwards of £20,000. After his return to England he founded the Zoological Society, of which he was the first president. He died in London, 5th July, 1826. See a Memoir of his life and public services, published by his widow (London, 1830).

RAFFLESIA is a genus of parasitic plants found growing on the stems of a straggling wild vine (*Cissus*) in the Malay Archipelago. The plant has no true leaves, but consists of a single large flower, which grows directly from its host. In the bud the flower is enveloped by large brown bracts. The corolla is fleshy, with a hemispherical tube and five reflexed spreading lobes. The first species discovered was named by Robert Brown *Rafflesia Arnoldii*; it was found by Dr. Joseph Arnold in 1818 in Sumatra, while travelling through the country with the governor of Bencool, Sir Stamford Raffles. As the flower measured a full yard across, weighed 15 lbs., and was capable of holding 12 pints of fluid, Dr. Arnold was justified in speaking of it as "the greatest prodigy of the vegetable world." The flowers have perfect stamens only, or perfect pistils only; and fertilization is effected by insects, which are attracted to the flower by its smell of tainted meat. In the middle of the flower there is a fleshy column, expanded into a disc at the top, and with one or two rings at the base. Below the disc in the male flowers there is a ring of cavities, each cavity containing a spherical sessile anther; the pistils are imperfect. In the female flowers the anthers are wanting or imperfect; the stigmas are situated on the top of the disc; the ovary has numerous branching cells, the walls of which are covered with ovules.

The genus *Rafflesia* belongs to the order *CYTINACEÆ* among the *Apetalæ*.

RAFTS are great accumulations of floating timber found in the large rivers of temperate latitudes, especially in North America. They are of considerable interest to the geologist, from the light they throw upon the occurrence of extensive beds of fossilized vegetable matter in old estuarine deposits, and also from their effect upon the currents of the rivers in which they accumulate. The floating trees are heaped together on being arrested by islands, shoals, or other obstacles, and the raft sometimes assumes such great proportions as to form a dam to the river waters and produce a lake. Sir Charles Lyell mentions one of these masses of fallen logs in the Mississippi which attained a length of 10 miles, was 220 yards wide, and averaged about 8 feet in thickness.

RAGLAN, LORD, FITZROY JAMES HENRY SOMERSET, Field-marshal and G.C.B., was the eighth son of the fifth Duke of Beaufort, and born 30th September, 1788. He entered the army in his sixteenth year, accompanied the Duke of Wellington as aid-de camp to the Peninsula, and in 1812 was appointed his military secretary, a post of peculiar delicacy, requiring the exercise of great tact, energy, and administrative ability. He served throughout the great European war of 1810-16; was the first to

mount the breach at the storming of Badajoz; and at Waterloo lost his right arm in a dashing cavalry charge. His bravery, indeed, was that of an ancient hero, and his calmness under fire was certainly never surpassed. In 1827, when the duke was appointed commander-in-chief of the British army, Lord Fitzroy Somerset was again called to the important duties of military secretary, which he discharged with a zeal and ability which could not be too highly commended, until the death of his great master and friend in 1852. He was then made master-general of the ordnance, and called to the House of Peers as Baron Raglan. On the breaking out of the Russian War he was selected for the command of the expeditionary force despatched in concert with the French to the Crimea, February, 1854, and under his guidance took place the battle of the Alma, the flank march to Balaklava, the famous charge of the "Six Hundred," and the battle of Inkermann. The siege of Sebastopol was then commenced, and the terrible winter of 1854-55 brought out into strong relief the deficient organization of the British army, which was most unjustly charged to the demerits of its commander. Though aged and in ill health, Lord Raglan calmly confronted the storm of public obloquy directed against him, and bore up against the heavy trials and cares of his position, until the repulse of the allied attack on the Redan and Malakoff, 18th June, struck his enfeebled frame with a mortal blow. He had been suffering from a slight attack of dysentery, but suddenly grew alarmingly ill, and died of mental as well as physical exhaustion, 18th June, 1855. His remains were brought to England and interred in the family mausoleum at Badminton. Lord Raglan was not a great general, but he was a good tactician and an able administrator; while his personal and private character, from its modesty, simplicity, gentleness, and assiduous devotion to duty, entitle him to share in the renown of a Sydney and a Bayard.

RAGMAN'S ROLL, the uncouth name of the collection of these instruments by which the nobility and gentry of Scotland were constrained to subscribe allegiance to Edward I. of England in 1296, and which were more particularly recorded in four large rolls of parchment, consisting of thirty-five pieces sewed together, kept in the Tower of London. These instruments are for the most part extant in the third volume of Prym's "Records," from page 618 to 665, and have been more correctly printed under the auspices of the Bannatyne Club ("Instrumenta Publica, sive Processus super Fidelitatis et Homagii Scotorum Domino Regi Anglia factis A.D. MCCXCVI-MCCXCVI"), 4to, Edinburgh, 1831. The records contain the largest and most authentic enumeration now extant of the nobility, barons, landholders, and burgesses as well as the clergy of Scotland, prior to the fourteenth century.

RAGNAROK ("the Darkening of the Region," in other words, the "Twilight of the Gods") is the weird and enthralling account of the downfall of the Norse dynasty of Ases, brought about by their deterioration and conscious loss of purity. The gigantic wolf Fenris, long held down by force, got free, Loki, the god of mischief, broke his bonds, the Midgard Snake, encircling the world for ages, now reared its head, for the gods were not able to maintain their force now that their virtue was tarnished. These horrible beings were joined by the horde of Hrimthurses, frost giants, by the sons of Muspel in their armour of fire, and Surtur, their leader, swinging a flaming sword, brighter than the sun. The bridge Bifrost broke under the weight of the host. Wotan and the Ases, although knowing their doom, advanced to the last battle, and received the shock of the giants in full career, and the poisonous spittle of the horrible monsters, who defended them with a frightful clamour. Father Wotan himself did battle with the Fenris Wolf, the most awful of all these creatures. When at last the father of the gods fell before the wolf,

the battle was over, although with the last blow Widar slew the hideous creature. Freyer fell before Surtur; Thor died by the poisonous breath of Jormungander, daughter of Loki, as she reeled upon him when dying under the blows of his hammer; Heimdal and Loki perished by each other's hand. The ash Ygdrasil groaned like a living creature. Then Surtur drew himself up, and extended till his head touched the clouds, all round him was fire, and he flung his firebrand over the universe, which burst at once into flames. Heaven and earth alike perished in Surtur's flames; and when the fire went out, one vast ocean covered all things, no life was visible, not even a star shone.

Agas passed by before the morning star rose, and the dawn, following it, flushed the sky. A new sun came forth, and evoked a new earth from the waters, and afterwards green things from the earth. When the trees had grown there came out from a forest a youth and a maiden, Lif and Lifthrasir, who had slept in that spot as children all through the last battle and for ever since, preserved by a final miracle of Father Wotan. From these descend the races of men. Meanwhile the Ases, purified by fire, assembled on the plains of Ida in perpetual peace, and looking down on the descendants of Lif, beckoned them to climb higher and higher towards themselves, till haply at last they too should become divinities in the house of the All father.

This curious sense of the necessity of purification, even of the gods, of early belief, surely indicates a higher morality than that of the Greeks and Romans, who were content to worship the gods they had long outgrown, barbarous, often filthy, conceptions of the grotesque imaginations of the world's childhood.

RAGS, the fragments and refuse of cotton, woollen, worsted, linen, and hempen stuffs, now largely employed in manufacture. Linen, cotton, and hempen rags are extensively used in the manufacture of paper, and of late have become important articles of commerce [see PAPER]; and woollen and worsted rags are torn up to be used as wool. See SHODDY.

The quantity of linen and cotton rags annually imported into the United Kingdom ranges from 20,000 to 40,000 tons. The largest supplies are received from Russia, Germany, and France. Exclusive of the very large quantity collected at home, all the linen rags imported were until very recently employed in the manufacture of paper; but the Americans, who have for some years been large importers from the Mediterranean and Hamburg, occasionally come into the London market and purchase large quantities. The duty on rags was abolished in 1845. The imported rags are generally more dirty in appearance than the English.

There is considerable variety in the appearance of rags from different ports; but in general those from the north of Europe are darker and stronger than those from the Mediterranean ports. The latter are chiefly the remains of outer garments, and have become whitened by exposure to the sun and air; but since the improvements in bleaching, this does not enhance their value in the British market.

The value of the woollen rags annually imported into the United Kingdom varies considerably, but averages about £500,000, the largest quantities being received from Germany, Holland, Belgium, and France.

Those woollen rags which are unsuitable both for shoddy and paper-making are used for manure, especially in the culture of hops. Woollen rags are also used for making flocks or stuffing for beds, &c.; this process is performed chiefly by the aid of the same kind of engines that prepare pulp for paper; these wash the rags thoroughly, at the same time that they grind and tear them out into separate threads and fibres.

RAG-STONE or **RAG**, a provincial term for a hard coarse rock with irregular fracture. A prominent example is the *Kentish rag*—a limestone occurring in the NEOLITHIC strata of Kent, and extensively quarried for building-stone and road-metal.

RAGUSA, a seaport of Austria, in the province of Dalmatia, formerly the capital of a republic, and a great centre of commerce and industry. It stands on the coast, partly at the foot and partly on the steep sides of two hills on a small peninsula in the Adriatic, and has a population of 8000. It is fortified with walls and ditches, and the entrance to the harbour is commanded by a strong castle. The houses are large and well built; the streets are paved, but except two they are narrow. The principal buildings are the cathedral and the governor's house. The town is well supplied with spring water. The neighbourhood outside the walls is laid out in gardens, vineyards, plantations of orange and other fruit trees, with here and there pretty country houses and handsome fountains. Ragusa is the seat of a bishop, has a gymnasium, several schools, soaperies, liqueur distilleries, and shipbuilding yards. Its trade is now of little importance, and its real port is the neighbouring one of Gravosa, about a mile distant. Ragusa was founded in the seventh century by some fugitives from Epidaurus in Illyria, when that city was destroyed by the Slavi. It continued to be a republic under the successive protection of the Greeks, Venetians, and Turks, till 1806, when it was taken by Napoleon I., who erected it into a dukedom, which he conferred on Marshal Marmont. On the fall of the former, Ragusa was given to Austria. Earthquakes more or less violent have frequently occurred, one of which, in 1667, destroyed half the population. Two noble buildings survived the catastrophe—the palace and the custom house.

RAGUSA, a town in the island of Sicily, on the left bank of the river of the same name, in the province of Syracuse. Its population is about 20,000. It has a Capuchin convent and several churches, manufactures of cottons, woollens, and silks, and a trade in corn, oil, wine, and cheese. A petroleum rock is exported as *petra nera* after it has been deprived of its oil. The town was almost wholly destroyed by an earthquake in 1693. Near it stood the ancient *Hybla Heræa*.

RAG-WORT (*Senecio*), a flower with a spreading ray, the leaves pinnated, and the involucre marked at the base by small scales. There are several British species. The Common Ragwort (*Senecio Jacobæa*) is a perennial weed, which flourishes abundantly in pasturage ground, but is rejected by cattle.

RAHU is the name of the evil deity who, in the Hindu mythology, is responsible for the eclipses of the sun and moon. He obtained some of the *amrita* (nectar) of the gods which gave them immortality. He had not yet swallowed it, however, when Vishnu saw him and cut off his head. Only his massive head and throat were immortal, for these only had the *amrita* touched. Consequently, although he pursues the sun and moon, and sometimes catches them and swallows them up, they pass through his throat and reappear (*Mahabharata*).

RAIKES, ROBERT, the most prominent founder, if not actually the first promoter, of Sunday schools, was born in Gloucester, 14th September, 1736. His father was a printer, and conducted for many years the *Gloucester Journal*. Robert succeeded his father in the business in 1757, and successfully conducted it until his retirement in 1802. He was a man of piety and benevolence, and during his labours among the poor he was led to see that ignorance was one of the main sources of crime, and to introduce the system of Sunday schools for the children of the poorest classes. In 1780 he engaged four teachers in dame schools to give Sunday instruction in reading and the church catechism, the teachers being each paid one shilling for

their day's work. The scheme proved a great success, and having called public attention to it in the columns of his journal, his example was copied by other persons in different parts of the kingdom, and Sunday schools became established in a short period in most of the manufacturing towns of England. Raikes from the outset took an active interest in the promotion of the good work, and during the remainder of his life he had the happiness of seeing it extend in all directions. He died at Gloucester in 1811. At the centenary of English Sunday Schools, observed with much enthusiasm in 1880, an excellent statue of Robert Raikes was raised on the Thames Embankment, London.

RAIL (*Rallus*) is the typical species of the *RALLIDÆ*, a large family of wading birds (*GRALLÆ*.) The Common Rail (*Rallus aquaticus*) or Water Rail, so called to distinguish it from the Land Rail or Corn-crake (*Crex pratensis*), is a resident in Britain throughout the year, though from its skulking habits it is seldom seen. It is widely distributed over Europe and Asia, extending as far south as the north of India in the latter; and it is also found in Northern Africa. It is about a foot in total length, with a longer bill than the corn-crake. The plumage of the upper part is of an olive-brown colour, streaked with black; the under parts are slaty-gray, and the flanks barred with white. This bird frequents marshes, where it dwells among the dense beds of reeds, rushes, and other herbage. Through these the compressed form of its body enables it to pass with great facility, so that it can hardly be driven from its cover by any means. It is also able to swim and dive well. The nest consists of a mass of sedges and coarse grass, collected among the thickest herbage of its haunts. The eggs are from six to ten in number, of a delicate cream colour, with blotches and spots of light red and gray. The call-note of the male bird is loud and harsh, and both sexes utter a croaking cry.

RAILWAY CLEARING HOUSE. This is an institution established in Seymour Street, Euston Square, London, for the purpose of facilitating the monetary transactions between the different railway companies, somewhat on the same principle as the Banking Clearing House in Lombard Street. [See BANK.] Before 1842, when the Clearing House was established, each line of railway only booked as far as its own line went, when there was a fresh ticket to be obtained and a fresh change of carriages and luggage at every new line entered on. Had this system continued in force till now, railway travelling would have become intolerably irksome, as a person going from London to Inverness, for instance, would have had to change six times. It was to obviate these difficulties that the Clearing House for through booking was established. Its beginnings were very humble, but its progress was very rapid, so that though in 1847 its gross receipts were only £793,701, they now amount to £15,000,000 per annum. Since its establishment it has received and disbursed £250,000,000, or more than one-third of the whole national debt. The object of the institution is, of course, to make out and settle the accounts of the different railway companies one with each other, so as to afford to the traffic of the whole kingdom the facility of through booking, as if there were only one railway company in the kingdom and one proprietary. Without this, through booking would be out of the question if each company had to settle its accounts with every other company with which it exchanged traffic. It is this desideratum which the Clearing House supplies, of adjusting mutual obligations in a ready, quick, and economical manner. At the end of each month, instead of having to pay enormous sums to each other according to their respective shares of traffic, the accounts are settled by the payment of comparatively small balances. This balancing of accounts at the Clearing House is made monthly, quarterly, and yearly, and no perceptible discrepancy in the enormous balance-

sheets has ever been detected. What the goods and luggage traffic of the united lines must be may be gathered from the fact that the number of articles annually accounted for to the Clearing House by the stations, as left by passengers either in carriages or on platforms, or which have gone astray through other causes, amounts to nearly 1000 a day, or about 350,000 per annum. Of these nearly 95 per cent. are restored through the Clearing House to their owners. The method adopted for the recovery of lost luggage is very simple. A descriptive return of each article lost is sent daily to the Clearing House, and all answering the description of the property inquired after is sent up for inspection to London, and in this way almost all the property reaches its owner's hands.

The Clearing House when first established was not received with very particular favour by the railways; it was designed to benefit. Three years after its institution there were only sixteen companies on its books. Ten years later there were seventy-three. Now its books include almost all the lines of importance in the kingdom, and some of the lines of steamboats also.

RAILWAYS or RAILROADS are roads on whose surface are laid bars, formerly called *trams*, but now called *rails*, for the purpose of forming a firm and smooth track for the wheels of carriages, and so diminishing friction and resistance.

History.—The use of broad flat slabs of stone for wheel tracks was known at a very early period, and roads of this kind were certainly used by the ancient Romans; but the use of rails seems to have been introduced about the middle of the seventeenth century in the mining districts of the north of England. In 1676 certain collieries near Newcastle-on-Tyne were using tramways consisting of rails of timber for the conveyance of coals between the pit and the river, and by the beginning of the eighteenth century the practice had been adopted in many other places. The rails originally were formed of oak scantlings, connected by cross timbers of the same material, and fastened with oak trenails, and in the course of time plates and bars of wrought iron were added to the upper surfaces of the rails in order to increase their durability. Cast-iron rails were first tried by way of experiment at Colebrookdale Iron-works, in Shropshire, about 1767, and afterwards became very generally used. The next improvement was the introduction of a flange to the rails, by means of which the wheels were confined to their place on the track, and this method in its turn gave way to the *edge-rail*, which was raised above the ground far enough to allow a flanged wheel to run over it. Wrought-iron rails were first tried in 1805 by Mr. Nixon, but they did not entirely supersede cast-iron rails until 1820, when Mr. Birkenhead patented machinery for rapidly rolling them resembling that which is still in use. The benefits derived from the use of the tramway for the conveyance of coal naturally led to its employment for the conveyance of other merchandise and of passengers, and the advantages of the new roads became still more apparent when the locomotive engine was introduced. An account of the origin and development of this engine is given under *LOCOMOTIVE*. The first attempt to introduce the railroad on an important scale was made in 1821, when Edward Pease and some other members of the Society of Friends obtained an Act for the construction of a line between Stockton and Darlington. The first intention of the promoters of this scheme was to use horses, but George Stephenson, who was employed as engineer, succeeded in impressing Edward Pease with a high opinion of the locomotive, and another Act was obtained, in 1823, by which the company were empowered to work the line by means of locomotive engines. It was opened in 1825, and on the opening day a train of thirty-four vehicles, with a gross load of about 90 tons, was drawn over the line by one engine driven by Stephenson at a speed of over 12 miles an

hour. During the next few years several small lines were opened in England and Scotland, and in 1829 a line was opened for traffic between Liverpool and Manchester, the success of which led to an enormous development of railway enterprise. The London and Greenwich Railway was the first line opened, in 1836, that had a London terminus, and a considerable return to the shareholders was looked for from its exhibition as a work of art, it being built upon a viaduct of brickwork containing 1000 arches, 18 feet span, and 22 feet high. The line was accordingly made a show of with accessories of music and "special attractions." The managing director in his journeys along the line was attended by an official bugler, who played "See the Conquering Hero comes," and objects of interest, including a "wonderful naval torpedo, invented by the Earl of Dundonald," were exhibited at the stations. In a little while, however, the business utility of the line became sufficiently apparent, and the shows, music, &c., were abolished. In 1838 a line was opened between London and Birmingham, and by this time railway engineering had made such progress that the first train accomplished the whole distance at a speed of over 20 miles an hour. Within a few years from this period the foundations were laid of most of the existing trunk lines of railway in Great Britain, and though the new enterprise received a check in the disasters following the collapse of the railway mania of 1844-46, by 1850 the number of miles opened had increased to nearly 6000, the cost of which exceeded £200,000,000.

The success of the first railways in England speedily led to their introduction on the Continent, many of the lines there owing their initiative to British capital and being constructed by British engineers. In 1833 a system of railways to be owned and managed by the state was commenced in Belgium, and the same year the French government began a comprehensive system of surveys, and laid down a general plan of railway development for the whole country. The first railway in France was from Paris to St. Germain, and was finished in 1835. The first line in Germany was also opened in 1835, Austria following suit a year or two later, and a short experimental line was laid down in Russia, in the neighbourhood of St. Petersburg, in 1835-37. After this period the construction of railways was rapidly proceeded with on the Continent, private enterprise in most cases being stimulated by grants, guarantees, subscriptions, &c., from the various governments. The introduction of the railway to the United States of America preceded its introduction to the continent of Europe, three locomotives being imported from England in 1829, and the South Carolina Railroad, constructed so as to be worked by locomotives, being laid down in 1828-30. The mileage of construction after this about kept pace with that of the United Kingdom until 1850, when it began to take the lead, which it has ever since maintained. The railway mileage of the United States, which amounted to 40 miles at the end of 1830, had become 3361 miles in 1841, and at the commencement of the Civil War it amounted to upwards of 30,000 miles. The war seriously checked railway construction, but after its conclusion activity was renewed, and at the beginning of 1885 the mileage had reached the wonderful extent of 125,379 miles. The railway system has been developed with great energy in Canada, Australia, New Zealand, and India, the Indian lines being almost entirely constructed under government supervision and guarantee. In the further East railways have been opened successfully in Japan, where the natives display amazing readiness to adopt European ideas, but up to the present the officials of China have prevented the introduction of railways into the Celestial Empire. A short line of 9 miles was opened between Shanghai and Woosung in 1876, and it soon became popular with the common people, but it was purchased by the officials in 1877 and promptly destroyed.

The following table, compiled chiefly from the returns given in the *Statesman's Year Book*, will show the mileage of the railways of the world in 1886:—

States.	Miles.	States.	Miles.
EUROPE—		AFRICA (Continued)—	
United Kingdom, . . .	19,169	Natal, . . .	217
Germany, . . .	23,209	Mauritius, . . .	92
France, . . .	17,000	AMERICA—	
Russia, . . .	15,605	United States, . . .	125,379
Austro-Hungary, . . .	13,601	Canada, . . .	9,949
Italy, . . .	6,000	Brazil, . . .	4,143
Spain, . . .	5,420	Mexico, . . .	3,600
Sweden, . . .	4,000	Argentine Republic, . . .	3,050
Belgium, . . .	2,730	Chili, . . .	1,411
Netherlands, . . .	1,925	Peru, . . .	996
Denmark, . . .	1,150	Uruguay, . . .	271
Portugal, . . .	1,007	Venezuela, . . .	270
Norway, . . .	969	Columbia, . . .	140
Roumania, . . .	911	Guatemala, . . .	99
Turkey, . . .	904	Costa Rica, . . .	96
Greece, . . .	210	Nicaragua, . . .	90
Servia, . . .	155	Honduras, . . .	69
ASIA—		Paraguay, . . .	45
British India, . . .	12,005	Ecuador, . . .	40
Ceylon, . . .	184	San Salvador, . . .	38
Dutch East India, . . .	560	San Domingo, . . .	20
Turkey in Asia, . . .	317	AUSTRALASIA—	
Japan, . . .	250	New South Wales, . . .	1,643
AFRICA—		Victoria, . . .	1,621
Cape of Good Hope, . . .	1,523	New Zealand, . . .	1,550
Egypt, . . .	1,280	Queensland, . . .	1,300
Algeria, . . .	1,050	South Australia, . . .	1,060
Tunis, . . .	256	Tasmania, . . .	215
		Western Australia, . . .	76

With respect to the foregoing statistics, it may be observed that of the 18,861 miles open in the United Kingdom, England and Wales owned 15,340; Scotland, 2999; and Ireland, 2525 miles. The returns for Asia are incomplete, as they exclude the Russian lines, information concerning which is concealed by the Russian government as far as possible. It is known, however, that the Russian military engineers are busily engaged in the construction of a line in the direction of the Indian frontier, in order that the government may be able to bring pressure to bear upon England in that direction. The line is both costly and unprofitable, but military considerations have outweighed these defects. To counteract this movement on the part of Russia the British government are now busily engaged in the construction of frontier lines in India, in the planning of which military purposes are also made paramount. With respect to the cost of railways, the average in England is far in excess of any other country. It has been computed that while the United States lines have not cost more than an average of £11,500 per mile; Belgian lines, £13,280 per mile; German, £18,235 per mile; Irish, £13,871; and Scotland, £22,670, the English lines have cost £38,960. Among the reasons for this wasteful expenditure, the principal are the enormous sums paid as parliamentary and law expenses, amounting at least to £2000 per mile, and the excessive amounts demanded and obtained by landowners in compensation for land taken. Formerly the sums obtained by landowners as compensation for land damage were most exorbitant, and even now railways have to pay to private owners about double the value of the land required. Other items which have helped to increase the average cost of the English lines are the expensive tunnels, bridges, and viaducts constructed, and the large sums spent by the metropolitan lines. The original London and Blackwall Railway, built mostly upon arches, cost about £312,000 per mile; and the North London line, constructed in a similar manner, cost £325,000 per mile.

Still greater was the cost of the underground lines, the Metropolitan District reaching £374,000, and the Metropolitan £500,000 per mile.

Railway Legislation.—Railways in the United Kingdom being constructed by associations of private individuals, with a view to their own pecuniary advantage, as well as to public convenience, it is necessary that, on the one hand, legislative restrictions should be imposed to protect the interests of those who may, directly or indirectly, be affected by the formation of the railway; and, on the other, that the promoters of the scheme should be invested with considerable powers to enable them to carry it into effect. Land, buildings, rivers, canals, roads, &c., have to be intersected and otherwise interfered with; and while justice requires that no unnecessary injury should be inflicted on their owners or the parties using them, and that every unavoidable interference should be amply paid for, it is also necessary to prevent a plan likely to be of great public benefit from being defeated by objections arising from prejudice or private interest. Hence it arises that special Acts of Parliament are requisite for all railway companies.

In the ordinary way railways are started in the United Kingdom by private individuals, who form a company, or they are undertaken by the existing companies as additions to their systems. Where a new line is projected the promoters obtain subscriptions to the undertaking, and having made the necessary surveys, they apply for an Act of Parliament to incorporate a company for executing the works and to give them the powers required for that purpose. The Standing Orders of Parliament afford opportunity to petitioners in favour of and against the proposed scheme to state their case before that tribunal. The examiners of private bills see that the Standing Orders have been complied with previous to submission of the Acts of Parliament. A bill after passing the second reading in the House of Commons is referred to a select committee, which hears both sides and reports on the evidence, and after it has received the approval of the Commons, it has to undergo a similar ordeal in the House of Lords. As we have already observed, the parliamentary charges are heavy, and sometimes reach very high amounts. It cost the Great Western Company £88,000 to obtain the necessary Act of Parliament, and other companies have had to disburse even larger sums since that event. The parliamentary proceedings in respect to such applications have undergone many changes, and are liable to change in each session of Parliament. For detailed and precise information the Standing Orders of both Houses of Parliament must be consulted.

With regard to the supervision of the railways after construction, the Regulation of Railways Act, 1873, appointed a commission with very extensive powers for the protection of the public and the promotion of equity in the management of the various lines. The members of the commission, three in number, are chosen for their legal and technical knowledge, and they are empowered to act as arbitrators in contentions between railway companies or in case of differences between the companies and public bodies or individuals. Their principal duty is to see that the companies comply with the terms of the Railway and Canal Traffic Act of 1854, and provide reasonable facilities for receiving, forwarding, and delivering their own traffic and that of other companies without showing unreasonable preference.

Construction, &c.—In the laying out and construction of the earliest railways, the natural declivities of the ground were followed. Afterwards the practice was by degrees introduced of moderating those declivities by embanking or arching across valleys, and by cutting or tunnelling through hills, as well as the practice of avoiding interference with the traffic of roads and streets, by carrying the railway over or under them by means of bridges; until at length the works, in earth, masonry, timber, and iron, employed in the construction of railways have become the greatest of all

mechanical structures. The extent to which it is advisable, on a proposed line of railway, to moderate the declivities or "gradients," and so to diminish the cost of transport, by means of works which increase the cost of construction, is a question for the judgment of the engineer.

The most formidable of the works of construction for a line of railway are in general tunnels; and they are, therefore, avoided where not absolutely necessary. The excavation of tunnels is easiest in rock that is sound enough to stand without artificial support, without being so hard as to present special difficulty in its excavation. The time and cost of tunnelling increase on the one hand with the hardness of rock, and on the other with the softness of earth; and the most difficult and dangerous tunnelling is in earth softened by water. Tunnelling in hard rock by machinery and explosives saves both time and cost.

Cuttings or excavations of great depth and extent are of frequent occurrence where the railway passes through high ground, but not at such a depth from the surface as to require a tunnel. The depth of cuttings is frequently from 50 to 100 feet. The degree of slope necessary in the sides of cuttings varies greatly in different soils. Rock will stand when nearly vertical; chalk varies from nearly vertical to a slope of one horizontal to one vertical, or an angle of 45 degrees; gravel stands usually at one and a half to one; London clay, from one to one to three to one. Some materials require even a flatter slope.

Embankments are the artificial ridges of earth formed to support the railway on a higher level than the natural surface of the ground. Their dimensions are often fully commensurate with those of cuttings, from which their materials are mostly procured. In the ordinary mode of proceeding an embankment is formed simultaneously with a cutting, the earth waggons, filled from the excavation, proceeding along a temporary railway to the embankment, where they are tipped up to discharge their contents. The sides of embankments, like those of cuttings, require a slope, depending on the material.

The amount of masonry and brickwork required in the formation of a railway is very great. Arching of almost every kind is more or less required in viaducts, bridges, culverts, and drains; and simpler work in the retaining walls, station buildings, and other necessary structures. Viaducts of great magnitude are often executed for the purpose of crossing valleys at an elevation greater than could be conveniently obtained by embankment, and also for entering or passing through towns. They are made of stone, brick, wood, or iron.

Bridges are required for crossing rivers, and also roads, canals, and other lines of communication. They are built of stone, brick, wood, or iron. Skew-bridges are required where the crossing takes place at an oblique angle. The level of the earthworks, when completed, is called the *formation-level*, and is usually from $1\frac{1}{2}$ to 2 feet below the intended surface of the rails. Above the formation-level comes the *permanent way*, made by depositing a layer of broken stone or gravel, technically called ballast, to the thickness in the centre of about 2 feet. Upon the ballast, and buried in it, are the sleepers, which form a foundation and support for the rails. These are made of stone, wood, or iron, wooden sleepers being generally adopted in Great Britain. The latter are either transverse or longitudinal, and in some railways both kinds are used. They are saturated with a preservative substance, usually creosote, to prevent decay. Cast iron sleepers, often shaped like an inverted bowl, are used in climates where timber sleepers cannot be preserved. The sleepers support the rails at intervals of from 2 to 4 feet, except in the case of longitudinal sleepers, which give a continuous bearing. Chairs, almost always of cast iron, rest on the sleepers and support the rails. When the sleepers also are of cast iron, chair and sleeper are cast in one piece. Some rails are rolled of

such a shape as to dispense with chairs and rest directly upon the sleepers.

The *gauge* of a railway is the clear transverse distance between the rails of one track; and it determines the width across each pair of wheels of the engines and carriages, and to a certain extent the width of the engines and carriages themselves, which cannot safely be made to overhang the rails by more than 1 or 2 feet at each side. The commonest gauge in Britain is 4 feet 8½ inches, formerly called the "narrow gauge;" its adoption arose from its happening to be the gauge of most of the early mineral railways in the north of England. Other gauges range from 7 feet (the "broad gauge," introduced by I. K. Brunel) to 2 feet. From 5 to 5½ feet appears on an average to be the most convenient for main trunk lines. It is sufficient to allow of any speed up to 60 miles an hour to be used with safety. Broader gauges have some advantage in point of stability at extremely high speeds. Narrower gauges are useful and economical on branch lines of traffic, and where low speeds are sufficient. The old term "narrow gauge" has ceased to be applicable to the standard gauge of 4 feet 8 inches, and is reserved for gauges of much less width. In connection with this part of the subject experience has shown that a gauge much narrower than the standard is service-

enough for all ordinary purposes, both as regards speed and carrying capacity, and that lines of this character are unquestionably suitable for sparsely populated districts and half-developed territories, the cheapness with which they can be constructed being a set-off against limited returns. A decided impulse has already been given to railway extension in such districts, and narrow-gauge lines ranging from 2 feet 6 inches to 3 feet 6 inches are working satisfactorily in Norway, Sweden, Russia, Canada, North and South America, and Queensland. The first instance of the narrow-gauge line being laid down in Great Britain was the Festiniog Railway, of about 18 miles in length, in Merionethshire, North Wales. Originally a horse tramway, laid to a gauge of 2 feet, this narrow road was retained when, some years after its construction, the experiment was made of running steam-engines and passenger trains upon it. The success of that experiment led engineers to see the utility of narrow gauges, and so much attention was attracted to the subject that the Russian government in 1870 sent a commission to visit and inspect the line. As a result of their visit several lines were constructed in Russia on this narrow gauge, which succeeded so well that Mr. Fahlie received a gold medal as a special token of the czar's appreciation.

Rails, &c.—Curves on a line of railway increase the resistance, and produce a tendency of the carriages to leave the rails. Sharp curves in combination with steep gradients and high speeds are to be avoided. The outer rail of a curve is elevated and the inner depressed, to counteract centrifugal force. As to contrivances for adapting engines and carriages to sharp curves, see LOCOMOTIVE.

The weight of rails depends on the heaviness and speed of the traffic, and ranges from 25 to 100 lbs. per yard; 15 lbs. per yard for each ton on the most heavily loaded wheel is in general sufficient.

Although, as already stated, wrought-iron rails are still largely in use, they are rapidly being superseded by steel rails, which, though more costly in the first instance, are so much stronger and harder, and last so much longer, as to render them the most economical in the long run. Under modern conditions of traffic on a busy line wrought-iron quickly wears into shreds, and it is apt to bulge and split in places. Steel rails, on the other hand, are worn away only by abrasion, and it has been calculated that the life of a good steel rail is from fifteen to eighteen times as long as that of one of wrought-iron.

Working or Rolling Stock.—The motive power which was first employed on railways, and which continues to be

employed in particular cases, was that of horses. On railways, as on common roads, the speed at which the efficiency of a horse is greatest varies, according to his breeding and other peculiarities, from 3 to 10 miles an hour. Gravity is employed as a motive power where the declivity of a descending gradient is sufficient to overcome the resistance of the carriages; and where the whole of the heavy traffic descends from a higher to a lower level (as in some of the local mineral railways) *self-acting inclined planes* are used, on which the loaded waggons descending draw up the returning empty waggons by means of a rope, supported by sheaves or pulleys. *Stationary steam engines* are used to draw trains of waggons or other vehicles by means of ropes, usually made of iron wire, up very steep inclined planes. The motive power employed on all main lines of railway, and on almost all branch lines, is that of the LOCOMOTIVE STEAM ENGINE. The carriages employed on railways are of various constructions, and for the main lines they include passenger carriage-

-baskets, travelling post-offices with their tenders and vans, goods' waggons open and covered, cattle trucks, coal waggons, timber trucks, &c. All passenger carriages, and all other carriages intended for high speeds, require to be supported on springs, in order to prevent vibration and shocks, and the consequent increase of wear and resistance. Draw springs, to prevent shocks from the action of the motive power, and buffer springs, to prevent shocks in stopping and backing, and to lessen the injurious effects of collisions, are necessary in all carriages driven at speeds above 10 or 12 miles an hour. The stopping of a train, when required, is usually effected by means of BRAKES, which act by friction on the circumferences of the wheels, against which they can be pressed when required by means of suitable mechanism, usually worked by the guard or guards of the train, and this is sufficient under ordinary circumstances. The latest and most approved brake is one on the pneumatic principle, worked for the whole train by the locomotive engine, and under the entire control of the driver.

According to returns recently published the working stock of the railways of the United Kingdom was as follows:—

Country.	Locomotives.	Passenger Carriages, Waggons, Trucks, &c.
England and Wales,	12,141	377,638
Scotland,	1,693	97,170
Ireland,	632	15,553
	14,466	490,661

These figures would give three engines for every 4 miles of line open throughout the United Kingdom, and an average of thirty-three vehicles per engine.

Railway Signals.—The earliest passenger lines were opened without any fixed signals, but very soon it was found necessary to arrange for the erection of posts from which signs might be made by means of flags, discs, &c., to the engine-drivers. In 1841 the old semaphore telegraph was adapted for railway use by Sir Charles Hutton Gregory, and it has since come into universal use for day-light traffic. Sometimes three signs are used, the arms of the semaphore being extended horizontally to signal danger, diagonally at an angle of 45 degrees to signal caution, and being caused to disappear within the post to signal line clear. More generally, however, two signals only are employed, viz., the horizontal and diagonal, or "danger" and "caution." For night signalling coloured plates of glass are caused to pass across the discs of lanterns, the three

night signals being a red light to signify danger, or line closed, a green or blue light for caution, and a white light for safety. As with the day signals, however, two only are now generally employed, the red light to signify danger and the green or blue to signify caution. Other signs used for the regulation of traffic are the signals made by the engine-driver with the steam whistle, to give warning that he is about to start, to stop, or to reverse, or that he is approaching a station, a crossing, or a tunnel, and whether he intends to stop at the station or run through. The use of electric signals sent from station to station in advance of an approaching train, to ascertain if the line is clear, has already been described under BLOCK SYSTEM.

Statistics of Railways in the United Kingdom.—The railways laid down in Great Britain before the present century were of very limited extent, and being entirely for the use of private establishments, were usually formed

without the authority of an Act of Parliament. The first line established in this country as a distinct undertaking, and intended for public use, was the Surrey Iron Railway, for which the company was incorporated in 1801. In the following twenty years not more than twenty new companies were formed; but in 1840 299 Acts were passed relating to railways. These sanctioned the construction of about 3000 miles, but many of the schemes were afterwards abandoned. By 1860 the mileage had risen to 10,433, and the cost to £348,130,127. In the following ten years, ending 1870, the progress was still greater, as by that year 15,000 miles of railway had been constructed, of which three-sevenths were single and the remainder double, and the capital absorbed was £550,000,000.

The following table gives the most interesting particulars of the railways of the United Kingdom from 1871 to 1885:—

ENGLAND AND WALES.

	Length of Line Open.	Paid-up Capital.	Passengers Conveyed (ex- clusive of Season Ticket- holders).	Weight of Goods and Minerals Conveyed.	Gross Receipts.	Working Expenditure.	Net Receipts.	Proportion of Working Ex- penditure to Gross Receipts.
	Miles.	£	No.	Tons.	£	£		Per cent.
1871	10,860	461,350,060	328,552,916	110,390,915	41,383,065	19,587,481	21,995,582	47
1881	12,807	616,437,119	561,175,291	209,532,870	57,210,132		27,501,236	
1885	13,612	677,180,162	622,169,911	218,748,094	59,320,905	31,474,841	27,846,066	

SCOTLAND.

1871	2,538	61,282,911	31,119,874	26,060,168	5,297,329	2,583,780	2,653,543	49
1881	2,927	91,819,089	47,211,419	33,939,472	7,278,591	3,731,002	3,547,589	51
1885	2,982	103,080,304	55,922,425	34,812,841	7,133,397	3,762,215	3,671,122	51

IRELAND.

1871	1,988	27,028,580	15,547,931	2,913,615	2,272,386	1,181,591	1,090,795	
1881	2,441	34,271,624	17,643,260	3,572,658	2,636,277	1,483,102	1,153,175	56
1885	2,575	35,597,589	19,120,662	3,727,516	2,801,532	1,550,893	1,250,639	

UNITED KINGDOM.

1885	19,169	815,858,055	697,213,031	257,288,454	69,555,774	36,787,957	32,767,817	53
------	--------	-------------	-------------	-------------	------------	------------	------------	----

It will be thus seen that the cost of working railways in this country amounts to about 53 per cent. of the returns from traffic; but the average dividend paid on British railways is only about 4 per cent., owing in a great measure to the large amount of capital wasted in parliamentary contests and the construction of rival lines. In looking over the railway enterprise of the world, it cannot but be remarked that, as a matter of profit to the shareholders, the railways of the United Kingdom are in rather a worse position than most others. Four per cent. is a small return as compared with the railway dividends in many countries. On the other hand, it must be remembered that British railways are entirely bona-fide commercial enterprises, whereas foreign railways have been to a great extent assisted by the state; and in return the state claims various privileges, in some instances, as in France, the whole plant becoming national property after a certain period.

Much might be said concerning the marvellous rapidity with which railway schemes have been developed in London, and the elaborate ramifications and imposing magnitude to which they have attained. The three stations—London Bridge, Euston Grove, and Nine Elms—of 1838 have grown to nearly 300 stations in the metropolitan district; and if the different companies having right of use of London stations are taken into account the

number of stations in London and its suburbs is, practically, in round numbers, not far short of 1000—an extraordinary advance upon the three of 1838.

In conclusion, it may be observed that the last few years have witnessed the completion of some very extraordinary railway undertakings. The greatest length of line constructed in any one country within the past ten years has been in the United States of America, but the greatest triumphs of engineering science over apparently insurmountable difficulties have been achieved in the hands of the Alps, the Himalayas, and the Rocky Mountains. The Americans (and more recently the Canadians) have carried the railway right across their continent from the Atlantic to the Pacific, embracing a length of 3300 miles. This distance may now be accomplished in eight days, and with scarcely so much fatigue as is experienced in a journey from London to Glasgow. Each train is furnished with Pullman's dining cars, which comprise a dining-room, kitchen, pantry, sleeping rooms, a staff of servants, and a store of provisions; so that the dining, lounging, smoking, reading, washing, and sleeping are all going on while the train is doing its 20 miles an hour. Formerly a mountain barrier separated Italy from the other parts of Europe, thereby cutting off ready communication from northern Europe to that beautiful country, and to the Mediterranean ports which open a path to Egypt and the East. The

conquest of the Alps by the locomotive, however, has been achieved. The close of 1870 witnessed the completion of the Mont Cenis tunnel, after the laborious efforts of sixteen years, and in 1871, while two of the greatest nations of Europe were locked in deadly conflict, the crowning triumph of the peaceful arts was inaugurated and opened for traffic. The great success and advantage of such a work having thus been shown, a similar project was commenced at St. Gothard, the tunnel in this case being 9 miles in length. Mont Cenis itself, before the completion of the tunnel, was crossed by a railway laid on part of the regular diligence road over the Alps; and it would seem that there are no ascents so steep but what may be overcome by modern ingenuity. The centre-rail system of Mr. Fell and the bogie carriages of Mr. Fairlie have each contributed to this result. [See *LOCOMOTIVE*.] In 1880, in order to shorten considerably the direct route southward to Brindisi, the French commenced another Alpine tunnel, to go beneath the Simplon, which will be $11\frac{1}{2}$ miles in length. Invalid visitors to Lucerne are no longer debarr'd from enjoying the invigorating air of the high on account of the difficulties of the ascent, for by an ingeniously constructed railway any one may go up and down, if so minded, several times in the day. The Bhore Ghat incline, on the Great Indian Peninsular Railway—one among the lines celebrated for the tremendous mountain precipices around which it is carried by means of tunnels, viaducts, embankments, overhanging galleries, and sharp curves—rises by a comparatively easy gradient 1831 feet in 16 miles. A railway in Mexico, beginning near the sea-coast at Vera Cruz, has curves so sharp that it requires 10 miles of line to do 2 miles of direct distance, and it has bridges over ravines at a height of 359 feet above the stream below; but the steepest incline rises 3770 feet in 21 miles, or about 1 in 30. The railway from Valparaiso to Santiago, remarkable for its curves, viaducts, and tunnels, rises 2642 feet in 12 miles, or about 1 in 21. On the Madison and Indianapolis Railway, in New Hampshire, there is an incline of 1 in 13, rising 400 feet per mile; between the rails is a cog rack, into the teeth or cogs of which a pinion beneath the locomotive works, thereby preventing any tendency to slip backwards. On the San Paolo Railway, in Brazil, there is an incline so steep as to rise 2550 feet in 5 miles, 510 feet per mile, or 1 in 10. There is a railway to the summit of Mount Washington, in New Hampshire, which has a slope very much resembling the roof of a house. A rise of 3600 feet is effected in a distance of only $2\frac{1}{2}$ miles, giving a gradient of 1 in 4. There are three rails, the centre one cogg'd to correspond with teeth in a centre driving wheel. The boiler of the locomotive is so suspended as always to maintain a horizontal position, and the engine pushes the carriages before it to prevent disasters by the breaking of coupling chains.

For a good account of the history of the early English railways see Smiles' "Lives of the Engineers," vol. iii. (1862 edition); see also Croall's "Book about Travelling, Past and Present" (Lond. and Edin., 1877). For the present position of the railways and the details of their working, see the annual reports of the Railway Commissioners. Full and accurate description of the capital of the various companies, its division into debentures, guaranteed and preference stocks, ordinary stock, &c., is given in Burdett's *Official Register*, published from time to time with the sanction of the London Stock Exchange. For American railways see Poor's "Railway Manual," which is the standard authority upon the subject.

RAILWAY, ELECTRIC. Notwithstanding the triumph of the steam engine in the early stages of the railway movement, and its splendid development since, there has always been a school of engineers and inventors who have endeavoured to find other sources of motive power, and among the forces most favoured with their attention

has been electricity. As early as 1842 an electro-magnetic locomotive was invented by Mr. R. Davidson and tried on the Edinburgh and Glasgow Railway, but the experiment proved unsuccessful, and it is only since the invention and perfection of the modern dynamo-electric machine and its converse, the electric motor, that it has become possible to practically work an electric railway. Under **ELECTRIC LIGHTING** the theory, construction, and working of dynamos or electric generators is explained, and it will only be necessary to note in this place that the essentials of the modern electric railways consist, first, of a generator or source of power; secondly, of a dynamo-electric machine, in which the energy drawn upon is converted into electricity; thirdly, an electric motor in which the electricity is reconverted into mechanical power and applied to turn the wheels of the train; and lastly, a pair of conductors by which the electricity is conveyed to and fro between the electric motor and the dynamo. When the armature of a dynamo-electric machine is forcibly rotated by means of steam, gas, or water power, the rotation gives rise to an electric current, and if the terminal of this machine is connected with another machine of the same character, the current generated in the first will cause the armature of the second to rotate in an opposite direction to its own. In this case the second machine is called an electric motor. The first public exhibition of electric power applied to the propulsion of carriages on a railway was that given by Dr. W. Siemens at the Berlin Exhibition in 1879, when a line 900 yards long with a 2-feet gauge was laid down, the power conveyed by a central rail to the motor being returned by the two working rails on which the car ran. In 1881 Messrs. Siemens and Halske laid down the Lichterfelde line near Berlin to be worked as an electric railway, and it has remained in constant use ever since. On this line, which is 2500 yards long, with a 39-inch gauge, the working rails are laid on insulating wooden sleepers, one acting as the outgoing and the other as the return circuit. Since 1881 the same engineers have constructed an electric line $1\frac{1}{2}$ mile long from Charlottenberg to the Spandau Boek, a short line in Costverloren Park, near Amsterdam, and they have applied their system to a line 700 yards long at the Zankerode Colliery in Saxony. At the International Electric Exhibition of Paris, held in 1881, an electric line was worked by Messrs. Siemens Bros., which carried an average of 13,000 passengers per week. In this line ordinary rails were laid down, and the current was conveyed by overhead metallic tubes having continuous longitudinal slits on the under side. A metallic bolt, drawn through the slits and connected by means of a flexible cable with the motor underneath the car, gave the required motion. A modification of this principle, by which a small carriage running on overhead conductors is connected by flexible cords to the motor, is that which is in use at the Charlottenberg and Zankerode lines. In September, 1883, an electric railway of 3 feet gauge and 6 miles long was opened between Portrush and Bushmills in the north of Ireland, which has been worked successfully up to the present. For this line the motive power is furnished by two turbines driven by a natural waterfall in the river Bush, the current being conveyed by means of an insulated third rail, which is rubbed by steel brushes attached to the Siemens motors which drive the car. The latter can be driven on the level at a speed of 12 miles an hour.

In addition to the lines mentioned several have been laid down for exhibition purposes at different places, and a permanent line has been brought into use at Brighton which conveys passengers a distance of nearly a mile along the parade. A proposition has also been made for an electric line to be worked in a tunnel between Charing Cross and Waterloo Station, London. It is intended to start the line at the north end of Northumberland Avenue, to pass it under the Thames by means of iron caissons, and to

continue it as far as the terminus of the London and South-western Railway. The necessary Act of Parliament has been obtained, and the works have been commenced.

From the foregoing it will be seen that although only a few years have passed since electric railways were devised, they have already made considerable progress, and it may be reasonably anticipated that electric propulsion has a great future before it. Even in the present stage it offers many advantages over the ordinary locomotive for light lines through difficult country, underground, and elevated lines; and when certain initiatory difficulties, chief among which is the loss of power through leakage, have been overcome by electric engineers, it is not improbable that electricity will take the place of steam in many instances.

RAILWAY, PNEUMATIC. See PNEUMATIC DISSECTING RAILWAY.

RAIMONDI, MARCANTONIO, the most famous of the early Italian engravers, was born at Bologna about 1487. He studied design and engraving in niello under Francia. Marcantonio (he is seldom called by his surname) worked in the first instance in niello. His earliest dated engraving on copper is the "Pyramus and Thisbe," after his master Francia, 1505. In 1510 Marcantonio removed to Rome, where one of the first plates he engraved was from a drawing of Lucretia, by Raffaele, with which that master was so much delighted that he gave him his "Judgment of Paris" to engrave. This, which was a much more important work, Marcantonio engraved in a larger and bolder style, so as to gain Raffaele's full approval; and by his desire Marcantonio now devoted himself entirely to engraving his pictures. In order to carry out more effectually this great undertaking, Marcantonio collected about him a body of pupils and assistants, and thus founded what is known as the Roman school of engraving. During the ten years which intervened before the death of Raffaele, Marcantonio had engraved, under the immediate supervision of the great painter, a large number of Raffaele's finest designs, and with more identity of feeling and character than has ever been attained by any subsequent engraver. The sack of Rome (1527) not only put an end to all his prospects of papal favour, which, after having been clouded by a connection with an obscure work of Aretino's, were now again mending, but reduced him to poverty, the whole of his property having been destroyed, and he having to pay a heavy ransom for his own liberation. He withdrew to Bologna, where he died a few years after. While one of the earliest, Marcantonio remains one of the greatest of engravers. Though excelled in brilliancy, variety of tint, and picturesque character, his prints have never been surpassed for accuracy and precision of drawing, truth and refinement of expression, and painter-like feeling.

RAIN. The atmosphere surrounding the earth is known to consist of air and aqueous gas or vapour, having, whether separate or in combination, equal degrees of elasticity when their temperatures are equal. It is supplied with humidity by evaporation from the waters of the earth, and its power to hold the water in solution depends on its temperature; an increase of heat augmenting that power, and a decrease diminishing it.

Now the quantity of moisture in the atmosphere will at all times be nearly equal to the greatest quantity that can be maintained in it in a state of vapour at the existing temperature. Therefore if two volumes of air thus saturated with moisture, but of different temperatures, become by any means fixed together, a mean degree of heat results from the union; but the whole quantity of moisture in the sum of the volumes of air will be greater than that which the mean temperature can support, and the excess will of course be condensed or precipitated in the form of rain, snow, or hail, according to the temperature of the region through which the aqueous particles pass. But the chief cause of rain is the ascent of clouds into colder regions of

the air, in which their water-carrying powers are far less, and where consequently they are found to discharge their surplus water. The action of mountains in causing the wind, and therefore the clouds, to run up their slopes and so get chilled, is very efficacious in producing rain by this means.

Briefly stated, the three principal causes of rain are—(1) Ascending currents of air into colder regions, which produce the great tropical summer rains; (2) the contact of hot damp air with cold ground, which makes the west coast of continents so rainy; and (3) the setting in of a cold wind after a warm one, and the reverse, as when a north-west wind sets in after a south-west wind, or when a south-east wind follows a frost; or, generally, the mixture of masses of hot and cold air.

The dense mists which rest on the ocean near Newfoundland are precipitations caused by inequalities in the temperature of the ocean in the line of the Gulf Stream. The rains which frequently deluge the tropical islands are in part produced by the volumes of air which are intermingled by the sea and land breezes; and those which fall at the time of the summer solstice in Africa may be ascribed to the immediate precipitation of the vapours which flow from the seas to supply the place of the rarefied air above the heated lands; while the drought which prevails in the sandy deserts of that quarter of the earth is explained by the level character of those deserts, over which the currents of air may be supposed to flow nearly without interruption.

In tropical regions the quantities of rain which fall in different months of the same year are very unequal: at Bombay the mean monthly depth in June was found to be 21 inches, and in October 1·26 inch. In temperate climates the quantities differ much less, but more rain falls during the second half of the year than during the first. The mean of observations continued during forty years at London give, for the depth of rain from January to July inclusive, 3·539 inches, and from July to December inclusive, 12·147 inches. In 1860 Mr. G. J. Symons, F.R.S., began his great investigations, assisted by 164 contributors, and these rose in the course of a quarter of a century to nearly 3000, giving an immense mass of trustworthy observations on rainfall, &c. The rainfall over the United Kingdom at the sea-level varies from 60 inches at Cahirciveen in Kerry, to about 22½ inches on the east coast of England. In mountainous districts it sometimes amounts to more—as much as 102·58 inches being already reported in 1860, for example, from the one Windermere station; while in the extended and more accurate observations of 1884 no less than ten returns of over 114 inches are given in Cumberland, two of which, from the Styx, are of 173·74 and 181·75 inches respectively. There are four large tracts always giving over 80 inches of rain annually, these are—(1) The West Highlands, (2) Skye to Loch Lomond, (3) the Lake District, and (4) the Welsh mountains. An average of six years taken at Seathwaite in Borrowdale, 422 feet above the sea, gives 154 inches per annum; but it appears that the average annual rainfall of the whole United Kingdom is only about 32 inches.

It is difficult to form a really adequate idea of the enormous quantity of water represented by these simple 32 inches. Take, for instance, the case of England and Wales only, the area of which consists of 37,324,883 acres. Every inch of rain falling on an acre of space is equivalent to 22,622 gallons. If we multiply this by 32, and then multiply the total acreage above by the total number of gallons, we arrive at the immense number of more than 27 billions (27,000,000,000,000) of gallons, reckoning 1,000,000 millions to each billion. This enormous sum represents the quantity of water which on an average of years falls on the surface at the feet of the population of England and Wales, exclusive of the deposition of dew,

itself no very small or unimportant item in the water economy of the country.

The quantity of water actually used by the population on the same acreage varies with local circumstances—from 2 gallons per head daily in villages and isolated places, where water is obtained by personal labour, to from 30 to 50 gallons in cities and towns, where public supplies abound and considerable waste exists. The average quantity used throughout England and Wales for all purposes is estimated at 15 gallons daily per head, but as this is on every hand an increasing quantity, we will say 25 gallons. As the population is now about 25,000,000, 25 gallons per head would be 625,000,000 gallons daily, or a yearly quantity of 228,125,000,000. The brute population—horses, cattle, sheep, pigs, and dogs—is estimated at 50,000,000; and we will allow for their consumption and waste 5 gallons per head. This makes up a daily consumption of 875,000,000 gallons, to which we have to add the quantity required for the production of steam. Putting this at the excessive rate of 125,000,000 gallons, the grand total then amounts to 1,000,000,000 gallons per diem—which is only a seventy-fourth part of the total rainfall with which Providence blesses the country on an average of years.

The enormous power used by nature in the production of rain is quite appalling, though a shower seems such a gentle thing. It is quite a common occurrence for an inch of rain to fall in twenty-four hours of steady rain over 100 square miles, say a third part of Middlesex; and taking this as a basis for calculation it is instructive, and to many has also the interest of novelty, to put some of the energy expended into figures. Some of the energy only—for the energy used in raising the clouds, in driving them to the district where they rain, in blowing chilling winds upon them, &c., great as it is, we may leave out, and confine ourselves to the energy required to evaporate from the sea or other water-surface the amount of water which we have assumed to fall. A calculation founded on Joule's experiments as to measures of heat will show the amount of this energy. The mass of water contained in a space one inch deep and 10 miles square (100 square miles) is over 232,250,000 cubic feet (232,320,000 cubic feet), and as a cubic foot of water weighs 1000 ounces, say 62½ lbs., this quantity of water will weigh 14,520,000,000 lbs., say 645,000 tons. To raise all this to evaporation point would take as much heat as would lift about 1020 tons one mile high, and as would take 500,000 tons of coal to produce by economical combustion. Well may Professor Tyndall eloquently exclaim of snow, another form of rainfall, "I have seen the wild stone avalanches of the Alps, which smoke and thunder down the declivities with a vehemence almost sufficient to stun the observer. I have also seen the snowflakes descending so softly as not to hurt the fragile spangles of which they were composed. Yet to produce from aqueous vapour a quantity which a child could carry of that tender material demands an exertion of energy competent to gather up the shattered blocks of the largest stone avalanche I have ever seen, and pitch them to twice the height from which they fell." But rain is not to be estimated by the 100 square miles, it is a phenomenon continually occurring all over the globe. All the coal which could be raised by man in thousands of years would not give out heat enough to evaporate water for a few months' ordinary rainfall. Only the immeasurable heat of the sun is competent to produce so mighty a result.

An inch deep of water gives as much as 100 tons weight to the acre. Even therefore in the comparatively rainless region around London, which gives about 25 inches a year, every acre could collect and store 2500 tons of rain water during the year. The enormous energy of this great weight is at present altogether wasted; but in face of the

increasing price of fuel it presents a not unlikely problem for the engineering of the future if new sources of power have to be devised.

The warmth-giving power of rain is considerable, the rain warming the air as it falls through it. Careful experiments have shown that every gallon of rainfall gives out latent heat sufficient to melt 7½ lbs. of ice, which is the same as smelting 25 lbs. of cast iron; and this may be put in another way, as that every inch of rainfall is capable of melting a layer of ice of over 8 inches (8.1698 inches) in thickness. In fact, the warming effect of the continuous rains of the west of Ireland is found to be equivalent to half that derived from the sun.

The continual clearing of cultivated countries is modifying the effect of rain and the course of rivers, the climate and the agriculture, to an extent almost alarming. The first result of a considerable removal of timber is to loosen the ground formerly held together by the roots of the trees. The rain falling upon a hillside so denuded sweeps off the earth with the loose gravel and boulders, and deposits it upon the plains, fills up the river beds with it, or if not sufficient for that, causes large shoals and impedes or destroys the navigation. At the same time the rain runs more rapidly off bare hills than off those covered with trees, consequently it reaches the valleys and the rivers in large masses all at once, instead of trickling down in small quantities at a time; the result is the production of disastrous floods in the lower reaches of the river. The rivers of Northern Italy flow on the top of vast embankments which are raised year by year as the river-bed rises, and which alone prevents the whole of Lombardy from being periodically devastated with floods.

Rainy Regions.—Near the equator rain falls almost incessantly, especially at noon and soon afterwards, because the evaporation is so very great that the upward current of air is rapid and very moist, and the discharge of rain as the current reaches colder regions is often practically continuous. The wettest parts of the globe are the region of equatorial calms, such as the famous doldrums in the western equatorial parts of the Atlantic, and secondly, those spots where damp winds meet mountain ranges and are forced upwards by them. Of the latter the most striking example is Cherrapoonji, in the Khasia Hills of Assam, where the monsoon parts with the evaporation of the Bay of Bengal, and yields no less than 400 inches of rain per annum. Mabuleshwar is a station on the Western Ghats of India, not far from Bombay, and has the high average of 260 inches. Then follow the Western Highlands, and Cumberland and Welsh mountains of Britain, the west of Norway, the north-west of North America, and the coast of Southern Chili, and lastly the west coast of New Zealand. In all these cases warm westerly winds are blowing across large tracts of ocean, and are forced to run up the slopes of mountains, and become chilled into rain. The remarkable case may be cited of Santiago (lat. 33°), with a rainfall of only 14.10 inches, and Valdivia, which is but 7° of latitude further south, and yet has a fall of 116.2 inches.

Dry Regions.—The comparatively rainless regions of the trade winds have been spoken of, but the driest regions are (1) the great desert tract beginning with the Sahara and reaching through Arabia to Persia, continuing over the southern steppes of Russia; (2) the Desert of Gobi; (3) the Kalahari Desert of South Africa; (4) the Salt Lake desert of North America; (5) Peru and Chili, between the Andes and the sea; (6) the interior of Australia; and (7) Patagonia. The frigid zones have also comparatively little rainfall; when the air becomes full of snow, as it not unfrequently does, this is not so much due to a snowfall as to the dry powdery snow (not bound by a hardened surface due to melting and subsequent regelations, as with us) which is caught up and whirled into the

air by the blast, usually in a southward direction. There are two small ocean areas believed to be absolutely rainless, one of which is on the eastern edge of the trade wind zone, and the other a little to the south of Java. In the cases of the land deserts spoken of above, it will be found on investigation that their dryness is due to the influence of intervening mountains. Patagonia is dry because the westward slopes of the Southern Andes are wet; part of Peru is dry because the south-east trade winds have rained themselves dry upon the eastward slopes of the Andes; Gobi is dry because it is surrounded by mountains; the chains of the Atlas group dry up the winds which blow towards the Sahara, and the Himalayas and their continuations in like manner keep rain from Central Asia. The reader can work out the other examples with the map quite easily.

Regions of Autumn and Summer Rains.—In Europe the Alps divide these two, the northerly countries having a larger autumn rainfall, and those next to them southwards having a greater summer fall. The west of Ireland and Great Britain retain the subtropical character in many respects and have a winter rainfall, but the east of Great Britain counts October as its wettest month. France has 24 per cent. of its rain in summer, North Germany has 36, Central Russia 38, and the Ural district 53; showing how gradually the rainfall gets earlier in the year as we advance eastwards across the Continent. Köppen ("Rain Probabilities in some regions of Europe," in German, Vienna, 1868) has drawn a tabular view, of which the following are a few of the lines given:—

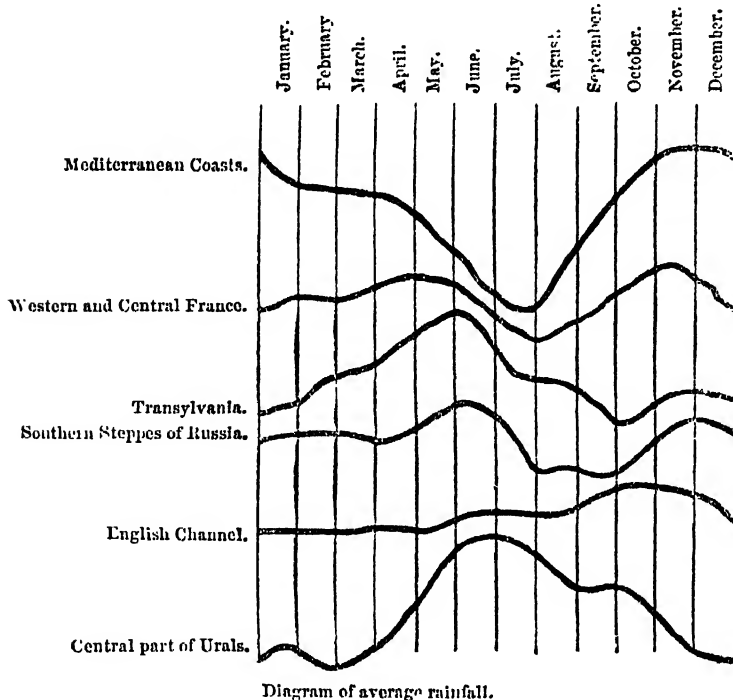


Diagram of average rainfall.

Regions of Winter Rains.—These are the subtropical countries between 30° and 40° lat. in both hemispheres, subject to the action of the return trades, which are the overflow from the calm belt, and bring with them abundance of rain. All the Mediterranean countries, Asia Minor and Persia, California and Oregon, the Cape, South-west Australia, and the north of New Zealand belong to this class. During the summer drought such regions use irrigation very largely. The

exceptions to the subtropical rule of winter rains are China, the eastern states of the Union in North America, the Argentine Republic, and Natal, all which enjoy abundant summer rain, and are exceptionally favourable to agriculture of all kinds.

All rain is either absorbed by permeable surfaces, or is discharged directly by overflow from impermeable surfaces into the rivers, whence the liquid reaches the sea. Permeable surfaces, however, do not entirely absorb that which falls upon them. Vegetation takes a portion, though a small one, and of the remainder there is another portion which escapes at the outcrop of the water-bearing strata in the shape of springs. Evaporation at the surface also takes effect, and draws off from the soil more or less of the water that is upheld by attraction, which again may be replaced by supplies rising from subterranean water beds.

From impervious surfaces and those that are nearly so the water passes off without much reduction, the only loss being from vegetation and evaporation. In the six months forming the summer half of our year, from April to September inclusive, the quantity of rain penetrating the earth beyond a depth of 3 feet is very small. Thus the water-bearing strata in Great Britain receive no appreciable replenishment during summer, and are nearly wholly dependent for their replenishment on the supersaturation of winter. The proportion of rain required to maintain the natural flow of our rivers during the summer and dry-weather periods of the year is about one-eighth of the average mean rainfall, or 1 inches over the whole of the river watersheds.

Taking the year through, the quantity or proportion of rain which finds its way over the surface as waste, to be discharged by the rivers into the sea without entering the ground at all, is at least 16 inches, or nearly four times the perennial flow, and nearly half the average mean rainfall.

RAIN GAUGE, a vessel for measuring the quantity of rain which falls on any particular part of the earth's surface, the quantity being indicated by the depth of the precipitated water which would cover the ground about the spot, supposing the ground to be horizontal, and that the water could neither flow off nor penetrate into the soil.

This instrument generally consists of a conical funnel, open both at the top and bottom, the lower extremity entering into a cylinder below, which thus receives the rain from the funnel. A graduated rod passes through a perforation in a bar fixed in the direction of a diameter of the cone at its upper surface, and is attached at the lower extremity to a circular piston, which has nearly the same diameter as the interior of the cylinder; the weight of the piston and rod is such as to allow the former to float with its upper surface on a level with the surface of the water.

The diameter of the funnel at the top may be 12 inches, and that of the cylinder 6 inches; in which case the area of the horizontal section on which the rain falls will be to that of the cylinder in the ratio of 4 to 1. Hence a depth of water equal to 1 inch at the horizontal section will be expressed by a space equal to 4 inches on the length of the rod; and each of such spaces being divided into 100

parts, the depth of water at the said section will be indicated in hundredths of an inch. The usual gauge is, however, 8 inches, the size preferred by the meteorological office. An inch of rain over 4 square feet is equal to a gallon of water, or 10 lbs., i.e., 100 tons to an acre.

Great care must be exercised in placing rain gauges. The greatest quantity of rain falls near the surface of the ground, therefore the gauge should be buried and should protrude only about a foot. If the gauge is fixed on a building the eddies of wind caused by the walls of the building will destroy the accuracy of the gauge. Every one is familiar with the lull in the wind felt on approaching closely the edge of a tall cliff on a stormy day with the wind blowing from the sea; a lull caused, of course, by the upward current of the wind which has dashed itself against the face of the cliff, and which for the moment thrusts upward into a quick curve the main stream of the blast. Just so will the drops of rain be carried over and past a gauge on the top of a wall over which the wind is blowing. For instance Dr. Robinson of Armagh had a very perfect and curious gauge of his own devising erected on the parapet of the observatory, 30 feet from a dormer window. Once he went out in a violent storm of rain with wind, to observe the behaviour of the gauge; and though he got wet through in crossing only the few feet of the leads of the roof he found not a drop of water had fallen into the gauge.

RAIN-BAND. Very early in the career of spectroscopy several bands were found in the solar spectrum which were due not to the gases of the sun, but to the action of the earth's atmosphere; and in 1860 Brewster and Gladstone conducted the first important investigation into their nature. These researches were carried further by Professor Cooke of America, who made it quite clear that the "telluric" or earth-derived lines depended on the moisture of the atmosphere, becoming strong when the air is humid, faint when it is dry. Thus just as the barometer measures the pressure, so does the spectroscope measure the humidity of the air, by means of the rain bands.

In 1864, Janssen, using a spectroscope with five prisms, succeeded in resolving the dark bands by Brewster and Gladstone into fine lines, and ascertained that these lines vary in strength. They are darkest at sunrise and sunset, and weakest—but never entirely absent—at noon. Observing next from the summit of the Faulhorn, about 9000 feet above the sea-level, he found that these lines were still further reduced in strength. In order to ascertain whether they are entirely due to our atmosphere, he caused large pine-fires to be made at Geneva, about 13 miles from the Faulhorn, and observed the spectrum of the flame. As he found that some of the dark lines were seen which are observed in the spectrum of the setting sun, it was proved that these lines are caused by our own air. To ascertain next what part the aqueous vapour has in producing them, he made use of an iron cylinder 118 feet long, placed at his disposal by the Paris Gas Company. After exhausting it of air by forcing steam through it, he filled it with steam, and closed both ends by pieces of strong plate-glass. A bright flame—produced by sixteen gas-burners—was placed at one end of the cylinder, and analyzed by means of a spectroscope placed at the other end. The light, after thus travelling through 118 feet of aqueous vapour, gave a spectrum crossed by groups of dark lines corresponding to those seen in the spectrum of the horizontal sun. Janssen proved, indeed, in this manner that almost all the lines then seen are due to aqueous vapour. To make assurance doubly sure, he extended his observations to the fixed stars, to see if similar lines appear in their spectra. The results of his observations of these spectra accorded well with those he had already obtained. In 1872, the attention of Professor Piazzi Smyth, astronomer-royal for Scotland, was drawn to the rain-band. Since then, he has been a devoted student of what is

termed rain-band spectroscopy, and has published the results of his observations. In the beginning of September, 1882, he based a prediction—published in the *Scotsman*—of a spell of fine harvest weather upon the exceptional faintness of the rain-band at that time. The prediction was brilliantly successful. Too great hopes were built upon this, in the same way that the barometer is often too blindly relied upon as a weather glass; but after all deductions there is no doubt that we are in possession of a most valuable aid to meteorology in the rain-bands.

The principal rain-band appears in an ordinary spectroscope (say of the size of one's little finger) as a shaded band (whence the name) rather than as a sharp line like any of the Fraunhofer absorption lines: in wet weather it exceeds the latter in prominence, but in fine weather might easily be overlooked. It is situated just on the orange side of the well-known double sodium-line D, dividing the orange from the yellow region. With the usual small rain-band spectroscopes the D lines are thickened in rainy weather, and a shaded band of from three to six times their width appears on the left-hand or orange side. If the shaded band is broad and very dark, and is visible when the spectroscope is directed towards the sky at an angle of 45 degrees, then rain may be confidently expected in from six to twelve hours. A faint rain-band is usually visible near the horizon an hour or two after sunrise. This is not at all necessarily followed by rain.

In rain-band spectroscopes of greater power the rain-band may be split up into a number of fine lines, among which two stand out very much stronger than the rest, in the position shown in the figure. In the magnificent instrument of Professor Smyth these are further divided, the right-hand line, next sodium D, into a pair of lines not quite so far apart as the two D lines, and the left-hand line into a grand triple, of which the nearer line sometimes attains greater blackness than even the great D lines themselves. The rest of the rain-band is made up of several thin lines in and about the D lines; then a number of close lines, forming a broad band on the orange side of D, between them and the first double line of the great rain-band pair; then one or two narrow bands of fine lines between the double and the triple rain-band lines; then on the orange side of the latter three distinct equal-spaced isolated bands; and further away in the orange a stretch of faint haze and haze-bands. All these melt into the one thin rain-band of the smaller spectroscopes.

RAINBOW, a circular arch of variously-coloured light which is visible in the heavens when the sun or full moon is shining, and when, at the same time, a shower of rain is falling—the spectator having his face to the shower and his back to the sun or moon. When the rain is abundant, a second bow is commonly seen on the exterior, and concentric with the first; their common centre being a line drawn from the luminary through the eye of the spectator, and produced towards the opposite part of the heavens. Both bows consist of concentric bands of the different prismatic colours arranged as they appear in the solar spectrum [see LIGHT, section: *the Spectrum*], but the order in which they are exposed in the first bow is inverted in the second. The lower edge of the interior bow is violet and the upper edge is red; on the contrary, the lower edge of the exterior (secondary) bow is red and the upper edge is violet.

It is quite possible that the significance given to the

End
Line

3 2

Position of the chief
Rain band Lines in
the Spectrum: 2, the
double line; 3, the
grand triple line.

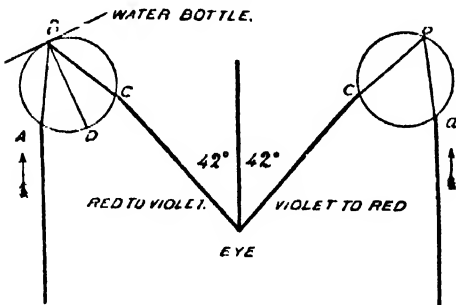
rainbow in Genesis arises from the rainbow being a new phenomenon to the authors of the account of the flood, for they may have migrated from a rainbowless region. The Nile country and many other tracts are practically rainless, and rain rarely falls in any tropical regions except at mid-day or by night. Rainbows hardly ever occur anywhere in the region of the trade winds. West Indian negroes cannot be made to believe in them or conceive of them any more than of snow.

The circle of light which is occasionally seen surrounding the sun or moon at some distance from the disc of the luminary, is called a *halo* or a *corona*, and is caused by the refractions of light in particles of ice which float in the air. See HALO.

Newton ascribes the earliest explanation of the bow to Antonio de Dominis, bishop of Spalatro; but Descartes is certainly the first who has distinctly explained the causes by which two bows of bright light may be produced. He gives, however, no indication of the bands of colours of which they consist; and it was only when Newton had discovered the different degrees of refrangibility in the different coloured rays which compose a pencil of common light, that there could be assigned the cause of those coloured bands, their position, and the breadth which they occupy.

The colours of the rainbow and their arrangement show that some kind of prismatic refraction has taken place, and the study of the phenomenon must therefore be directed to the explanation, first, of the cause of this refraction, and secondly of the circular form and continuous shape of the rainbow. The prismatic refraction is due to the spherical shape of the raindrop. When light falls on a sphere of water some passes through it, some is reflected from the front surface, and some from the back. That light which is reflected from the back is also refracted, on account of the denser medium which water affords as compared with air. [See LIGHT, sections *Reflection* and *Refraction*.] The effect of light falling upon a sphere of water can be very conveniently shown experimentally by throwing a bright light from a lamp upon a water-bottle full of water (the bottle having a clear uncut spherical body, and the light falling upon one side of its surface, as in fig. 1), and

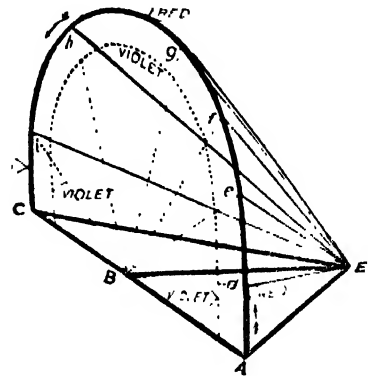
Fig. 1.



placing oneself on the opposite side of the bottle to that on which the light falls, in such a position that the ray as it issues at the point C shall make with the eye an angle of 42 degrees at the perpendicular. Then the light entering at A will be refracted at B, and will therefore be reflected from B, so that the angles of incidence and reflection are equal when compared with B D, the normal to the tangent at B; (that is, the angle $\angle A B D = \angle D B C$), which will carry it to the point C, whence it will issue to the eye, not in the line B C, but refracted as much towards the normal B D as it was when it entered the water at A. The eye will now see in the direction of the point C an image of the lamp, which will be coloured red on its left and violet on its right. Reversing the arrangement, so that the water-

bottle and the lamp are to the right of the eye at precisely the same positions, the image will be coloured in reverse order, violet on the left and red on the right. Now, the eye being at E (fig. 2), and the first position of the water-bottle at A, and the second at C, imagine the water-bottle shifted round a semicircle in a vertical plane in the direction of the arrows, taking up successively the positions *d*, *e*, *f*, *g*, *h*, *i*, then it is evident that the angles $\angle B E A$, $\angle B E d$, $\angle B E e$, $\angle B E f$, &c., to $\angle B E i$ inclusive, will be all angles of

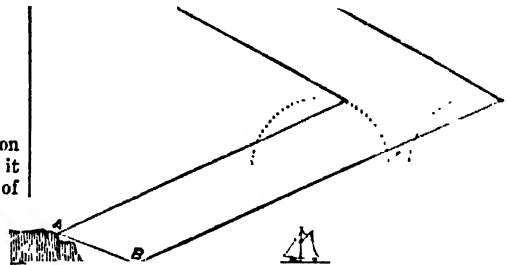
Fig. 2.



42 degrees (reckoned to the red or outer circle), whilst the angles $\angle A B E$, $\angle d B E$, $\angle e B E$, $\angle f B E$, &c., to $\angle i B E$, will all be right angles. Also, it is quite evident that the red edge will form the outermost arc and the violet the innermost arc, and that by multiplying positions and having a simultaneous display of coloured overlapping images, an exact representation of a rainbow would be secured. In the experiment it would be necessary to shift the position of the lamp as the position of the water-bottle shifted, but in nature the sun is so far off that its light seems to come in parallel rays, and thus is the same for all positions of the water-drops in the rainbow arc.

Occasionally a rainbow may be seen reflected in still water. When this is the case usually no rainbow is seen in the sky. The reason is obvious on looking at fig. 3. The rainbow seen by direct vision from the cliffs when standing at A is quite a different bow, and one much nearer than that which would be seen at B by reflection in the lake. If the rare occurrence should happen of a bow being seen in the sky simultaneously with one in the

Fig. 3.

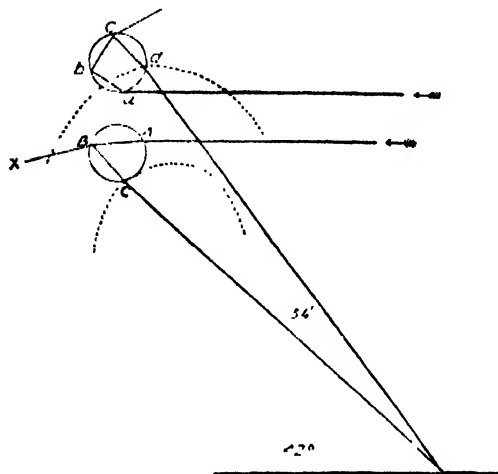


lake, the latter will be smaller than the former, and its feet will not coincide, but will be within those of the direct bow, simply because, as the reflected bow is more distant, it appears smaller than the direct bow by the ordinary rules of perspective. It is manifestly impossible to see the same bow by direct vision and by reflection, because the angle subtended by the sun and the eye is unalterable,

and therefore is limited to one particular semicircle at each moment. Therefore no two persons can see the same rainbow. The marvellous wealth of colour with which the air must teem at such times, had we only the power to multiply our eyes to see it, is really awful to conjecture.

Sometimes a secondary rainbow is seen outside the first, the eye and the sun subtending an angle of 54 degrees at the outside band—the violet, in this case. For as in the

Fig. 4.



primary rainbow the sunlight enters the drop at *a* (fig. 4), and is refracted to *b*, whence part passes away as at *x*, and the rest is reflected to *c*, thence to emerge as part of a rainbow-spectrum; so in the secondary rainbow the sunlight enters at *a*, is refracted to *b*, when part emerges; the rest is reflected to *c*, whence part emerges towards *x*, and the much-diminished remainder is again reflected to its issue at *d*, where it is seen by the eye as part of a reversed rainbow spectrum, the violet being the top of the arc and the red the bottom. It is observed that the light enters beneath, not above, in the 54-degree rainbow, and the order of colours becomes inverted by the double reflection within the drop. The faintness of the colours of the secondary bow is due to the loss of light at the points *b* and *c*.

It is only from very elevated positions that a rainbow of a greater arc than a semicircle can be seen; but from a balloon a completely circular rainbow may sometimes be observed when the balloon is at the right angle above the clouds. In ordinary positions the bow is only a complete semicircle when the sun is on the horizon. If the sun is 42 degrees above the horizon the bow will be beneath the horizon, the crown of the arch being, perhaps, just visible; with the sun above 42 degrees no part of the bow is visible. The sun must not be higher than 30 degrees to give a fine bow. The lower the sun the greater the arc of the circle shown by the rainbow; and in consequence mid-day rainbows are in temperate climates very rarely seen. A portion of a bow has occasionally been seen in an inverted position on the ground by the refraction of the light in drops of rain adhering to the grass or the leaves of trees. It may be added that a coloured bow similar to that which is produced by rain may be observed in the spray from a fountain when the jet of water is agitated by the wind, and also in the mists which at times lie upon low grounds.

Frequently inside the violet arch of the primary, or outside the violet arch of the secondary rainbow, we see a series of coloured bows alternately red and green.

These are called supernumerary bows, and are the results of the "interference" of light.

Extraordinary Rainbows are those which are occasionally formed by the sunlight reflected from the surface of water, and not by the direct rays of the sun. Such rainbows do not coincide with primary rainbows, and have even been seen placed laterally with respect to them, as in a recorded instance at Kirkwall, 13th November, 1871.

Fog-bows are uncoloured (white) rainbows seen on a thick fog, often shortly before its disappearance. Their diameter is between 38 and 41 degrees, and the width of the band of the arch varies with the size of the water-drops composing the fog; the smaller the drops the broader the band.

Lunar Rainbows are frequently so faint as to escape notice unless attentively searched for. They often appear merely as a whitish or yellowish arch, and are rarer than solar bows because it is only the full moon which has light enough to produce them.

RAISED BEACHES, accumulations of shingle, sand, clay, and exuvie of marine organisms, occurring as terraces upon the sea-coast somewhat above the present high-water mark. They are, in fact, old foreshores that have been raised above the level of the sea by upheaval of the land, and are undoubted proofs of this upheaval, since they do not occur universally, as would be the case if the alteration had been produced by the sinking of the water. Excellent examples occur in many localities on the Scandinavian coasts, where they sometimes rise, terrace upon terrace, even up to a height of 500 feet. Dr. Geikie has also described three or four successive raised beaches in some parts of Scotland, and there are numerous minor cases upon the English coast. Portions of Brighton are built upon an old beach (including the so-called *Elephant Bed*), which has yielded bones and teeth of the mammoth and other extinct animals. Other examples occur in Dorsetshire, Devonshire, and Cornwall.

RAISINS. The dried fruits of several varieties of the vine are called raisins, a term derived from the French, *raisin*, in that language being a general name for grapes, the dried fruit being distinguished as *raisins secs* or *raisins passés*.

Raisins are named after the countries where they are produced, or the places whence they are imported, as Malaga, Valencia, and Smyrna. The peculiar small and generally seedless grapes, formerly called *corinths*, are now better known as the dried or Zante *CERANAS* of the shops. In Malaga, whence the best raisins come, the usual method of preparation is by simply drying in the sun. Compartments are made of brick or stone, inclined to the full power of the sun, with the interior thickly spread with fine gravel to absorb the heat. As soon as the grapes are gathered they are placed in these compartments, and attain a temperature of 145° Fahr. Any grapes which remain green are picked out, and the rest carefully turned, one by one, to preserve uniformity of colour. At night they are covered with canvas or planking. The process takes ten days for completion. Sometimes, when the weather is not favourable, the groups are scalded in a lye made from the refuse of the grape after pressing, and heated to 212° Fahr. Another process is to dry them by steam after first exposing them to the sun's rays for twenty-four hours. Another method is to cut the stalk half-way through when the grapes are nearly ripe, and leave them suspended till the watery part is evaporated; the flow of sap is in a great measure prevented from entering the fruit in consequence of the incision, and while evaporation continues to go on undiminished desiccation must take place.

The *current*-grapes are gathered in the end of August and beginning of September. Rains often spoil the crop when they occur at the time of gathering or drying. The

fruit, when sufficiently dry, is separated from the stalks by small rakes, and afterwards stored in magazines, "seraglie," constructed somewhat like a lime-kiln, having an opening at top, where the fruit is put in, and a door at bottom, opened only at the time of sale. The fruit is rendered so compact by its own weight that considerable force is requisite to break it up for the purpose of being packed in the large casks in which it is exported.

The Malaga raisins are esteemed the finest, and the muscates from thence exceed all others in price. The black Smyrna raisins are those of least value. The white grape of Alexandria furnishes very fine raisins.

The small fine species, called *sultanas*, are from Turkey. Nearly all the raisins imported into this country come from Spain and Turkey. A small supply is received from Portugal, Italy, Egypt, and Cape of Good Hope. Raisins are packed in drums of 21 lbs. each, in boxes of 22 lbs. and 56 lbs., and in casks of 1 cwt. and $2\frac{1}{2}$ cwt. The customs duty on raisins imported into the United Kingdom is 7s. per cwt. The quantity received in 1885 was 583,862 cwt., of which 423,112 cwt. were entered for home consumption.

RA'JAH (*Rājā*), a Hindia term, representing the nominative singular of the Sanskrit *rajan*, king, prince, or chief. It is derived from the root *raja*, to be resplendent, and to this root are to be traced back the French *roi* and the Latin *rex*. In primitive times every petty chief was called *raja*, possibly because of the splendour of his dress and ornaments, and at a later period the term became the common designation of a king, whether he ruled over a small or over a large state. At the present day the title is borne in India by many persons who are merely large landowners, and it is frequently bestowed by the British government as an honourable title upon persons deserving of honour. In addition to these persons there are numerous petty princes who enjoy a limited amount of power and independence, who are termed *Rajahs*, and others of higher rank, who bear the titles of Maharajah, great prince, or Adli Rajah, first prince. The feminine of *Rajah* is *Ranee*, and the title *Maharanee* is commonly used by the Hindus as the designation of the British queen.

RAJPOOTS' or RAJPUTS (Sanskrit, *rajan*, king, and *putra*, son; hence the word literally means sons of kings) is the name of various Indian tribes of Aryan origin, who have either sprung from the extinct royal dynasties of the Hindus, or are the representatives of their *kshatriya* or warrior-caste.

RAJPUTANA, so denominated from its prevailing population, the Rajputs, is a great territorial circle in India, including the British district of Ajmere-Merwara and nineteen states, each having its own autonomy and separate chief. This territory lies between the parallels of 23° and 30° N. lat., and 69° 30' and 78° 15' E. lon. The total area is approximately estimated at 130,000 square miles. On the west Rajputana is bounded by the province of Sind in the Bombay Presidency, and on the north-west by the native state of Bahawalpur under the Punjab government; thence all its northern and eastern frontier marches with the Punjab and the North-western Provinces; on the south-east it is bounded by the territories of Sindhia, Holkar, and other native states of the Central India Agency; and on the south-west its frontier marches with the Gujarat native states of the Bombay Presidency. Within this area the states of Jeysulmere, Jodhpore or Marwar and Bickaneer lie in the west and north; Ulwar and the Shekhawati tract of Jeypore in the north-east; Jeypore, Bhurtpore, Dhulpur, Kerowlee, Boondee, Kotah, and Jhalawar are the eastern and south-eastern states; Sirhoee lies in the south-west, while Partabgarh, Banswara, Dungarpur, and Oodeypore or Meywar lie in the south. In the centre lie the British district of Ajmere-Merwara, the states of Kishengarh and Shahpura, and parts of Tonk.

Rajputana is divided into two main divisions by the Aravalli range of hills, which runs through it in a direction nearly north-east and south-west, about three-fifths of the territory lying north-west of this line, and two-fifths on the south-east. The north-west division comprises the whole vast tract stretching from Sind on the west, and along the southern Punjab frontier, to near Delhi on the north-east. The character of this tract, which radiates with a constant though very slight slope towards the Rann of Cutch and the Indus, is throughout uniformly sandy, unproductive, and ill watered, though improving gradually from a mere desert in the west and north-west to comparatively habitable and fertile lands towards the north-east and north. Immediately beyond the mountain's skirt the soil alters from hard rock to sand mixed with very little loam, and the country, as far as the beginning of the desert proper, or up to the Loni River, consists of a succession of gentle swells clothed with rather thick, low jungle, fairly peopled, and to some extent cultivated. Beyond the Loni River, and from the edges of the Rann of Cutch, stretches north-eastward through the states of Mallani, Jeysulmere, Jodhpore, and Bickaneer, the great desert of Northern India, known as the Tharr, a vast sandy plain, traversed in the interior by long waves of sandhills. The character of this desert region is the same everywhere, consisting of long straight ridges of sandhills running in parallel lines, separated by short and fairly regular intervals, and varying from 50 to 100 feet in height, sparsely clothed with stunted shrubs and tufts of coarse grass, with wells few and deep, rendering agriculture difficult, and towns and villages at long distances apart. In the north-eastern angle of Rajputana the country is not so near a wilderness as in the extreme north and west, yet a great extent is comparatively waterless and waste. Some few parts, however, have a better soil, and in these the principal towns are well built and fairly prosperous. The sub-montane region, lying immediately under the northern slopes of the Aravallis, varying in height from 600 to 2000 feet, and absorbing the drainage up to the Loni River, is well cultivated, especially along the banks of the Loni, and has many substantial villages. The general level of the country in the north-west division is lower than the country on the south-eastern side of the Aravallis.

The second great division of Rajputana, south-east of the Aravallis, contains the higher and more fertile country. In contrast to the sandy plains, which are the uniform feature, more or less modified, of the north-west, this south-eastern division has a more diversified character and kinder soil. It contains extensive hill ranges, and long stretches of rocky woodland, traversed by considerable rivers with wide vales, fertile table-lands, and great breadths of excellent soil. Meywar country occupies all the eastern flank of the range, at a level 800 or 900 feet higher than the plains of the west; and whereas the western slopes of the Aravallis, towards the Jodhpore country, are abrupt, on the eastern (the Meywar, Kishengarh, and Jeypore side) the land falls very gradually as it recedes from the long parallel ridges, spreading out into the open champaign country of the centre of Meywar, though on the south-west corner of this tract the outskirts of the main range become entangled in a confused network of outlying hills and valleys, covered with forest, and known as the Meywar Hill Tracts. From November to June this portion is easily traversed, but during and after the rainy season many swamps form, and the river beds are often an impassable food. All the south-east of Rajputana is watered by the drainage of the Vindhya. In the extreme south-east corner there is a long narrow strip of country called the Chaumela, and on the eastern side a remarkable plateau called the Patar, upon which lies almost all the territory of Kotah, with parts of Boondee to the north of Kotah, and of Jhalawar to the south of it. From the south this table-land is

ascended by three distinct steppes or elevations out of the Malwa plain, and the line of hills which marks its eastern edge runs round by Chittore to Mandalgarh. The north-western face of this plateau is very distinctly marked by the line of the Boondie Hills, which run like a wall from Mandalgarh north-west to Indargarh. Eastwards this plateau falls towards the Gwalior country so gradually that the general aspect would not suggest a raised plateau, though the three low steppes leading up to it from the south and west are very distinctly marked. The surface of this plateau is more or less stony, with wide uplands, broad dips or levels, containing deep black culturable soil between the hills, the summits of which are rugged, irregular, barren, or covered with vegetation. Between the Chambal and Parbati rivers there is a considerable tract of rich, black soil. Beyond the Patar, to the north-east of the junction of the Banas and Chambal rivers, there is a very rugged region, consisting of several ranges of no great height, running parallel with the river's course, and separating the Chambal basin from the uplands. Further northward the country smooths down and opens out towards the Bharatpur territory. In the north-east corner of the Oodeypore state, about the town of Jihazpur, and within the Boondie territory adjoining, is a rugged bit of country called the Mina Kherar. Further southward again, in the south-east corner of the same state, is another stretch of hill country and jungle, inclosed by the towns of Oodeypore, Dungarpur, Purbagarh, and Neemuch, called the Chappan, one of the most difficult and troublesome in Central India. The Bhakar is another tract of very rugged hill country lying over against Abu, to the east of the Sirohi state, inhabited by Grassias, a half-blood tribe between Bhils and Rajputs.

Of the mountains and hill ranges the Aravallis are by far the most important; they mark off the whole of Rajputana into two natural divisions, separating the desert plains of the north-west from the more fertile and kindlier region of the south-east. There is great difficulty of communication across the section of the Aravallis between Meywar and Marwar, which vary in height from 2600 to 4000 feet, and the only pass really practicable for wheels and general traffic is that of Dasuri. Further south the hills decrease in height, and spread out until the chain loses its distinctive formation amid wide tracts of hilly wastes, extending southward over the whole western half of Meywar.

Of rivers, the Chambal is by far the largest in Rajputana, flowing through the province for about one-third of its course, and forming its boundary for another third. It rises in the summits of the Vindhya, upwards of 2000 feet above the sea, and is about 650 miles in length. Next in importance to the Chambal is the Banas, which rises in the south-west of Meywar, collecting in its course all the drainage of that tract, and joining the Chambal a little beyond the north-east extremity of the Boondie state, after a course of about 300 miles. There are no natural fresh-water lakes in Rajputana; the only considerable basin is the well-known salt lake at Sambhar. There are, however, large artificial lakes within Meywar, built with the object of storing water, viz., the Debar, Kankroli, Udisagar, and Pichola lakes. Several lines of railway run through the province.

• The climate of Rajputana as a whole may be reckoned as one of the healthiest in India, at least for its natives. The moderate rainfall, the free play of the winds over its surface, the sparse population, the absence of great cities, and the plentiful supply of salt, may be some of the reasons why the inhabitants live long and thrive well. In the summer the sun's heat is much the same all over the province, and except in the high hills is great everywhere, in the north-west very great. Hot winds and dust storms are known more or less throughout. In the winter the

climate of the north is much colder than in the lower districts, with hard frost and ice on the Bikaner border, and from the great dryness of the atmosphere the change of temperature between day and night is sudden, excessive, and very trying sometimes. The rainfall is very unequally distributed throughout Rajputana. In the north-western part, i.e. in Jeysulmere, Bikaner, and the greater part of Jodhpore, the fall scarcely averages more than 5 inches. Dew is here for the great part of the year the substitute for rain. In the south-west the fall is much more copious, and in the south-east it is most abundant. In the south-west highlands of the Aravallis it sometimes passes 100 inches. In Meywar the country is never subjected to the extreme droughts of the north-west and west. In the central district of Ajmere and towards Jeypore the periodical supply of rain is very variable; in fact, to sum up, from the north-west to the south-east (excluding the Aravallis) there is a very gradually increasing rainfall from 5 to about 45 inches. Mount Abu is the sanitarium of Rajputana.

The mass of the people are occupied in agriculture. In the large towns banking and commerce flourish to a degree beyond what would have been expected from so backward a country. In the north the staple products for export are salt, grain, wool, and some cotton. In the south the great articles of export are opium and cotton. In other parts of Rajputana various kinds of cereals, pulses, and fibres are grown for native consumption. Melons grow in profusion in the sandy tracts, and supply food to the inhabitants for a considerable portion of the year. The main wealth of the desert lands of Marwar and Bikaner, however, consists of the vast herds of camels, horned cattle, and sheep, which roam over the sandy wastes, and thrive admirably in this dry climate on the nutritious grass of the country. From these pasture lands vast numbers of sheep are driven annually to Bombay; and camels and horned cattle are bred in such numbers that they supply the neighbouring provinces. The Bikaner camel is considered the largest, swiftest, and handsomest in India. There are no manufactures on any great scale. Woollen and leather goods are manufactured in the northern states, and steel weapons of a superior quality at Sirohi. Salt is extensively manufactured in Jodhpore and Jeypore from the great salt lakes of Sambhar, Didwana, Pokharan, and Phalodi in Jodhpore, and Kachor-Bewassa in Shekhawati, and at the salt works of Pachhadra in Jodhpore.

Of metallic ores and minerals, cobalt, iron, lead, copper, and alum abound in several parts of the Aravalli range, and in the minor ridges of Ulwar, Shekhawati, Meywar, Kotah, and Jhalawar. Building and ornamental stone, limestone, and slate are found in the Boondie and Ulwar hills, in the Aravalli range about Ajmere, and in Jeysulmere; the limestone of the Makrana quarries in Jodhpore and of Jeysulmere being noted, as well as the slabs from the quarries at Sillora in Kishengarh territory, used for purposes for which wood is employed elsewhere in India. The total population is a little over 10,000,000.

RAKOCZSY MARCH, THE, is the Marsellaise of Hungary, and is credited to King Francis Rakoczsy II. Its power over the Magyars is quite as great as that of the Marsellaise over the French, and for long years it was rigidly prohibited by Austria. It was the rallying cry of the great insurrections of 1848. It is a very wild and stirring irregular composition. Many composers have set it with more or less success, the greatest effects of this kind being that of Berlioz in his "Damnation de Faust," and the elaborate orchestral arrangement by Liszt.

RAL'EIGH, SIR WALTER, born in 1552 at Hayes, in the parish of East Budleigh, Devonshire, was the second son of Walter Raleigh. He was entered a commoner of Oriel College, Oxford, in or about 1568. In 1569 he accompanied a volunteer corps to France in aid of the

Huguenots. He served in France five years, and subsequently in the Netherlands, as a volunteer under the Prince of Orange. In 1576 Sir Humphry Gilbert, Raleigh's half brother, obtained a patent to colonize any parts of North America not settled by the allies of England. Raleigh and Gilbert attempted a joint expedition, from which the former returned unsuccessful in 1579. In the next year we find him commanding a company of the royal troops in Ireland during the rebellion raised by the Earl of Desmond, and on the 10th November of that year he took part in the massacre of some 600 Spaniards who had surrendered at Smerwick. Soon after his appearance at court his handsome person and attractive manners so far gained him the favour of the queen that he was knighted, made captain of the guard, seneschal of the county of Cornwall, and lord warden of the Stannaries, and had, with a grant of 12,000 acres of the forfeited estates of the Earl of Desmond, a lucrative patent for licensing the vendors of wine in England. In 1584, after the death of Sir Humphry Gilbert, Raleigh obtained a patent investing him with power to appropriate, plant, and govern any territories that he might acquire in North America. In 1585 the first body of colonists landed in Virginia, so called in honour of the virgin queen. After various disasters Raleigh, in 1589, finding that his resources were unequal to the forming of a colony, made over his patent to a company of merchants.

In 1587 Raleigh had been appointed one of a council of war to put the forces of the realm in the best order to withstand any invasion, and had command of the forces in Cornwall. In July, 1588, after the Armada had passed up the Channel, he joined the British fleet with a small squadron, and greatly distinguished himself in the several engagements which ended in the discomfiture of the Spaniards. In 1589 he accompanied the Lisbon expedition, the object of which was to place Don Antonio on the throne of Portugal. In 1591 he sailed on an expedition to intercept the Plate fleet, which was unsuccessful. On his return he fell into some discredit with Elizabeth, on account of his seduction of Elizabeth, daughter of Sir Nicholas Throckmorton, whom he afterwards married. After a short confinement in the Tower he retired to his estate of Sherborne in Dorsetshire. It was during this retirement that he formed his scheme for the discovery and conquest of El Dorado, an imaginary land of gold and silver in South America. He sailed from Plymouth, 5th February, 1595, with five vessels, and arrived at Trinidad about the end of March. He surprised the newly-founded town of San Josef, and took prisoner the governor, Don Antonio Berrio, from whom he extracted information which enabled him to ascend the Orinoco about 60 leagues, when he was forced to return. He arrived in England towards the end of the summer (1595). Raleigh published an account of this voyage, under the sounding title of "The Discovery of the large, rich, and beautiful Empire of Guiana." In 1596 he was employed, with the rank of rear-admiral, at the taking of Cadiz, where he greatly distinguished himself, and was severely wounded in the leg. In 1597 he took Fayal in the Azores by storm, without waiting for the arrival of Essex, and thus aroused the jealousy of the latter, which ultimately ripened into a permanent estrangement. About this time he was restored to his post of captain of the guard, and appointed governor of Jersey.

After the death of Elizabeth his fortunes fell. Cecil, his former friend and associate, had completely poisoned James's mind against him. The post of captain of the guard was speedily given to another, and his wine patent was withdrawn. An opening soon offered for a more serious attack. Lord Cobham's plot in favour of the Lady Arabella Stuart was discovered, and Raleigh was arrested as a conspirator. In September, 1603, he was tried at Winchester, and found guilty of high treason. Whether or not

he was morally guilty may be questioned; but that his condemnation was procured by the power of his enemies, and that the verdict of the jury was not justified by the evidence, there can be no doubt. He was reprieved, and sent to the Tower, where he was confined for thirteen years. His family suffered severely by his attainder. During his long imprisonment he turned to intellectual pursuits, and, with many minor pieces, executed his great work, "The History of the World."

In 1615, Cecil being dead and Somerset disgraced, Raleigh induced Sir Ralph Winwood to recommend his project of opening a mine in Guiana. Upon this he was released conditionally. He equipped thirteen vessels for this expedition. The fleet reached the coast of Guiana in November, 1617. He was so unwell that he could not ascend the Orinoco in person. Captain Keymis, his steady follower, led the exploring party. A conflict took place with the Spaniards near St. Thomas, a small town recently built, in which the Spanish governor and Raleigh's eldest son Walter were slain; after which Keymis, having spent about twenty days in a fruitless search for the asserted gold mine, returned to the fleet, and meeting with nothing but reproaches for his ill success, committed suicide. Raleigh sailed for Newfoundland to victual and refit, but on arriving there his own crew mutinied, and the majority declaring for a return to England, he was forced to accompany them. He arrived at Plymouth, July, 1618, and was shortly afterwards arrested. James, strongly urged by the King of Spain to punish him for his attack on St. Thomas, laid the case before his council, when it was argued that Raleigh, being under an unpardoned sentence for treason, could not be tried again. James therefore resolved to carry into execution a sentence sixteen years old, which had been followed by an imprisonment of thirteen years. He was brought up before the Court of King's Bench to receive sentence, and was beheaded the next morning, 29th October, 1618.

Great of heart as Raleigh was, he had few scruples, and with all his alert vigour of mind he had neither tact nor prudence. His Virginian colony, upon which he nobly expended an immense sum, failed altogether; his gold mines of Guiana were mere illusion; his grants from the crown made him one of the most unpopular men in England, and he was excluded by the very sovereign who pampered him from all the higher offices of state. He was possessed by a hatred of Spain which would not suffer him to let her alone when she had ceased to be formidable. He wrote much and he wrote well; but he has left only one or two short pieces of lasting interest. Nevertheless, by his courage and versatility, by his fearless spirit of adventure, by his ardent, if unscrupulous, patriotism, by his eager interest in literature, his quick imagination, his rich and melodious eloquence, he has fully won his place among English worthies. He was a shining figure in the most resplendent age of English history. His faults were many, but were surely redeemed by the calmness with which he bore misfortune, his heroic patience under persecution, and the splendid courage of his last hours. His life has been written by Oldys, Cayley, Patrick Fraser Tytler, and Mrs. Creighton; and his "Complete Works" were published at Oxford, in eight vols. (1829). See also "Raleigh, Sir Walter, with letters now first collected," by Edward Edwards (London, 1868); S. R. Gardiner's "History of England," 1603-16 (1863); and "Raleigh," by Edmund Gosse, in the English Worthies Series, edited by Andrew Lang (London, 1886). An excellent volume on "Raleigh in Ireland," though it judges the hero too severely, not making sufficient allowance for the temper and prejudices of his times, was published by Sir John Pope Hennessy in 1883.

RALENTANDO, RITARDANDO, and RITENUTO (Ital., becoming slower, held back), musical terms,

abbreviated *rall.*, *ritard.*, and *rit.*, signifying that the time of the movement is gradually to be taken slower.

RALLIDÆ is a family of birds belonging to the order GRALLÆ. In this family the wings are short, and fit closely to the body. The legs are moderate, with the toes, especially the anterior, very long and slender. The bill is generally short, much compressed, and wedge shaped. The body is very thin, and unusually flattened, a structure particularly adapted to their habits, since they live for the most part in the tangled recesses of those reeds and aquatic vegetables which clothe the sides of rivers and morasses. They are for the most part solitary and timid birds, hiding themselves at the least approach of danger, but quitting their semi-aquatic retreats in the morning and evening, to feed in more open spots. Their flight, from the shortness of their wings, is feeble, but they run with swiftness; and by the peculiarly compressed form of their body are able to make their way through dense masses of reeds and high grass with so much facility as to escape even after being desperately wounded. This large family may be divided into four subordinate groups—Ralline, containing the Rall. (Rallus) and Corn-crake (Coryx); the Moon-hens (Gallinulæ); the Coots (Fulicæ); and the Limpets (Heloniinæ). The last-named subfamily contains some curious forms from the tropics, having the feet lobed, as in the coots, but with a long bill; it contains two genera, Helionis, with only one species from tropical America, and Podica, with two African species and one Indian. The JACANAS, formerly referred to this family, are now considered to form a distinct family, Podicæ.

RAMADAN, the ninth month in the Arabian calendar, and a sort of Lent observed by the Mohammedans, in obedience to the express command of the Koran. During this month every good Moslem, unless travelling or an invalid, is bound to fast from the first appearance of day-break until sunset. All corporeal enjoyments are absolutely prohibited, and the devout, if they are compelled to take medicine, compound for the involuntary sin by giving alms to the poor.

RAMAYA'NA, THE, is one of the two great ancient epic poems of India, the Mahabharata being the other. Rama was one of the incarnations of Vishnu, and this poem tells his history in 24,000 lines of great poetical finish. It is at once older, more perfect, and more homogeneous than its fellow; and whereas the latter seems to have been the work of many poets, the Ramayana is as clearly from one poet as the Iliad. There are two texts, the best editions of the elder one being that of Bombay (1861), and that of Madras, in Telugu characters, three vols. (1856). Partial translations exist by Carey and Marshman (Cawnpore, 1810), prose, and by Griffiths (London, 1871), verse; but no complete translation has as yet been accomplished.

RAMBOUILLET, MARQUISE DE (CATERINA DI PISANI), was born at Rome in 1588, and married at the age of twelve to M. D'Angennes, who became Marquis of Rambouillet in 1611. Shocked at the immorality of the court, the Marquise de Rambouillet determined to create a refined circle of her own. She soon succeeded most admirably, and all that was beautiful and charming in French society, led by the fair De Longueville, met all that was studious, all that was learned and artistic, at the réunions at the Hôtel Rambouillet for fifty years, from Malherbe, Balzac, and Voiture to Corneille, Molière, and La Rochefoucauld. Richelieu recited his own works, and Boileau preached his first sermons to this select coterie. The exquisite talent for conversation which distinguishes high French society is believed to derive its traditions from this famous salon. Yet so far was it from being an assembly of bluestockings and pedants that Molière's "Précieuses Ridicules" was first performed at the Hôtel; a fact which at once disposes of the oft-repeated assertion

that the satire of the great master was levelled at the marquise. In truth it was levelled at those who imitated the pedantic externals of learning without the true insight and love of knowledge and of art which animated Madame de Rambouillet and her distinguished friends. The marquise died at Paris in 1665.

RAMEAU, JEAN PHILIPPE, a musician, was born at Dijon in 1683, his father being the organist of the cathedral there. After he had learnt the rudiments of music his taste for the art led him, while young, to leave his native country, and wander about with the performers of a German opera. At the age of eighteen he composed a musical entertainment, which was represented at Avignon with great success. He next became a candidate for the place of organist of the Church of St. Paul in Paris; but failing to obtain it, he had almost determined to renounce that branch of his profession, when he was prevented by the offer of the place of organist of the cathedral church of Clermont, in Auvergne, which he accepted. In this retirement he studied with the utmost assiduity the theory of his art. His investigations in the course of this pursuit gave birth to his "Traité de l'Harmonie," printed at Paris in 1722, and to his "Nouveau Systeme de Musique Théorique," printed at the same place in 1726. But the work for which Rameau is most celebrated is his "Démonstration du Principe de l'Harmonie" (Paris, 1750), in which he has shown that the whole of harmony depends upon one single and clear principle, namely, the fundamental bass. For this reason Rameau has been called the Newton of harmony. With such extraordinary talents as these Rameau could not be suffered to remain organist of a country cathedral. He was called to Paris and appointed to the management of the opera. His music was of an original cast, and the performers complained of its difficulty and strangeness. Besides his numerous works on theory, he composed a great many operas, ballets, &c. Louis XV., to reward his extraordinary merit, conferred upon him the ribbon of the order of St. Michel, and a little before his death raised him to the rank of noblesse. This great artist died at Paris in the year 1764.

RAMILLIES, a small village of Brabant, in Belgium, 13 miles north of Namur, was the scene of one of the Duke of Marlborough's greatest victories. Here, in 1706, he encountered the French and Bavarians, under Marshal Villeroi and the Elector of Bavaria, and totally defeated them after a struggle of three hours and a half. The French loss in killed and wounded was computed at not less than 13,000.

RAM'MOHUN ROY, RAJAH, a celebrated Indian reformer and founder of the BRAHMO SOMAJ, was born about 1774, in the district of Bardham, in Bengal. He was a Brahman by birth, and was trained by his father in the doctrines and observances of his sect; but his opinions seem to have changed at an early age. His father died in 1803, and he then published various books and pamphlets against the errors of the Brahmans, in the native and foreign languages. In order to deprive him of caste the Brahmans commenced a suit against him, which, after many years of litigation, was decided in his favour.

Of the body of Hindu theology comprised in the Vedas, there is an ancient abstract called the "Vedant, or the Resolution of all the Veds," written in Sanskrit. Rammohun Roy translated this work into Bengali and Hindustani, and afterwards published an abridgment of it for gratuitous circulation. Of this abridgment he published an English translation in 1816. He was at different times the proprietor or publisher of newspapers in the native languages, in which he expressed his opinion freely against abuses political as well as religious, especially the burning of widows. In 1820 Rammohun Roy published, in English, Sanskrit, and Bengali, a series of selections from the New Testament, entitled "The Precepts of Jesus the Guide to

Peace and Happiness." In 1830 he was engaged by the King of Delhi to make a representation of grievances to the British government, for which purpose the king conferred on him the title of Rajah. He arrived at London in April, 1831. The British ministers recognized his embassy and title, though the East India directors objected to both. His negotiation was successful, and added £30,000 a year to the income of the king. He intended to return to India, but died near Bristol, 27th September, 1833.

Rammohun Roy was acquainted more or less with ten languages—Sanskrit, Arabic, Persian, Hindustani, Bengali, English, French, Hebrew, Latin, and Greek. He was a believer in the divine mission of Christ, and seems to have considered the acceptance of his doctrines as consistent with a belief in the leading tenets of the Brahmanical religion. "The Last Days in England of the Rajah Rammohun Roy," edited by Mary Carpenter (London, 1866: Trubner).

RAM'NES, the original Latin shepherd-community from which Rome arose, by the junction with it of two other communities, the Titii (Sabines) and Luceres (Latins). The Rammians were the original, perhaps the larger stock, dwelling beside the Tiber, and they gave their name to the joint community, the change of *a* to *o* being in that stage of the language very common, as we see in *portio* from *pars*, *mors* for *maris*, &c. The meaning of Ramnes appears to be "foresters" (Mömsen). The word tribe (*tribus*, divided by thuds) comes from this tripartite constitution of the young nation.

RAM'PART (probably from Lat. *ripa*, an embankment, from which is derived the Italian word *riparo*, and the French word *rempart*) is, in modern fortification, a mass of earth often nearly 80 feet thick, surrounding a town or a military position, or constituting the faces of an outwork; and its use is to protect the interior of the place or work against any sudden enterprise of the enemy, as well as to give the defenders a superiority of elevation with respect to the works of the besiegers.

On the interior side of the rampart, towards the town, is a nearly level space, varying in breadth from 35 to 40 feet, called the *terreplein*; and on this the artillery is placed. The exterior and interior sides of the rampart are formed with slopes making angles of about 45 degrees with the horizon; or they are retained by revetments, or walls of brick or stone, nearly upright, the exterior face of the rampart constituting the *escarp* of the ditch in front.

RAM'PION (*Campanula Rapunculus*) is a biennial plant, indigenous to Britain as well as to various parts of the continent of Europe. It has a long white spindle-shaped root, which may be eaten in its raw state, like a radish, and is by some esteemed for its pleasant nutty flavour. Both leaves and root may also be cut into winter salads. The seeds should be sown at the end of May, in rather light soil, and thinly covered. The roots will be fit for use throughout the following winter.

A different plant, the *Oenothera biennis*, is sometimes called German Rampon. Its roots are used like those of the above, and the plants are cultivated in the same manner as carrots or parsnips.

RAM'SAY, ALLAN, was born in 1686, at a small hamlet on the banks of the Glengonnar, a tributary of the Clyde, among the hills that divide Clydesdale from Annandale, and was apprenticed to a barber in Edinburgh early in the last century. In the course of time, however, he exchanged this trade for that of a bookseller. His convivial qualities gained for him the acquaintance of many distinguished persons both in the literary and fashionable circles; and in 1721 he published a volume of his poems, which was very favourably received. In 1724 he published "The Evergreen, being a Collection of Scots Poems wrote by the Ingenious before 1600." The materials for this collection were chiefly obtained from the Bannatyne MS.

preserved in the Advocates' Library; but Ramsay has patched and renovated the old verses throughout to suit his own fancy. "The Evergreen" was followed the same year by "The Tea-table Miscellany, or a Collection of choice Songs, Scots and English," in four volumes, which has been often reprinted. Ramsay afterwards wrote many more verses in his native dialect; but his chief performances are his surpassingly excellent pastoral, the "Gentle Shepherd," published in 1729, and his continuation of the old Scottish poem of King James, "Christ's Kirk on the Green." Ramsay died in 1758. His son, Allan Ramsay the painter (1713-84), worked in London. He preceded Sir Joshua Reynolds in the post of principal painter to the king.

RAM'SES or **RAM'ESSES**, the name of some of the greatest of the Pharaohs of ancient Egypt. Ramesses I. was a descendant of the Hyksos or Shepherd Kings of the fifteenth and sixteenth dynasties, under the first of which Abraham journeyed in Egypt, and under the second of which Joseph flourished. After 500 years of subjection the Egyptians drove out the intruding dynasty. Ramesses may therefore be considered as of foreign descent, and when he advanced upon the kingdom of the exhausted eighteenth dynasty, at the death of its last prince, he occupied much the same position as that filled by our William the Conqueror. Under Ramesses I. and the beginning of the nineteenth dynasty in 1443 B.C., the empire soon arrived at great splendour. His son Seti still further extended it and consolidated it, and his wealth is shown by the building of Karnak. He married the heiress of the eighteenth dynasty, therefore his son Ramesses the Great (Ramesses II.) united every claim, like our own Henry II., who coupled the Norman and English royal descents. Ramesses II. is the grandest and best known figure in ancient Egyptian history. He ascended the throne when a young man and reigned sixty-seven years, dying at the age of ninety-six or even more. He married thrice, and had by his wives twenty-three sons and eleven daughters; but adding the children born to him by his concubines his family amounted to 111 sons and fifty-nine daughters. He fought one great war with the Syrians at the beginning of his reign, and this contest ended in his taking Jerusalem and other cities. The rest of his long reign was devoted to the peaceful ruling of his country, and to never-ceasing building of those splendid monuments throughout Egypt and Nubia which have made his name so well known to us. The mummy of this great king and that of the great warrior-king Thothmes III. of a previous dynasty, were discovered in 1881 in a subterraneous rock-cut sepulchre in the western plain of Thebes, a fact which caused much excitement and interest. The mummy was opened by Maspero, at Cairo, in 1886, and the face, after the lapse of thirty-three centuries, retains its normal expression of indomitable pride and sovereign authority. Ramesses II. was over 6 feet in height, and we see by the breadth of his chest and the squareness of his shoulders that he must have been a man of great bodily strength. The body is that of a vigorous and robust old man, bald on the crown, but having abundant white hair on the occiput, and with heavy white eyebrows; with high-bridged nose, curiously like the familiar "Bourbon" type, thick lips, and massive under jaw, white and well-preserved teeth, long and slender hands and feet, stained with henna, and ears pierced for the reception of earrings.

Ramesses the Great gives the historic basis for the legendary Sesostris of the Greeks. The successors of this magnificent monarch were not able to hold together his vast empire. The exodus occurred not under Ramesses II., as is sometimes thought, but towards the close of the reign of the Syrian usurper Arish, who closes the period of the nineteenth dynasty at about 1314 B.C. To oppress an industrious community was a crime

quite foreign to the noble soul of the great Ramses, and it is most unjust to seek to fix it upon him. Ramses III. (twentieth dynasty) is the *RHAMPSINITOS* of Herodotus. Maspero uncovered his mummy at the same time with that of Ramses II.; and both may now be seen in the cases of the museum at Cairo, the faces being left exposed. Ten other monarchs in all bore this name at various periods, but none of them are very celebrated.

RAMSEY (in Norse, *Hrafsum*) is a rapidly rising town, situated on the north-eastern coast of the Isle of Man. It stands at the mouth of the Sulby river, the largest stream on the island. Ramsey is increasing in importance as a watering-place, and has become a fashionable place of summer resort. A large amount of produce, from the rich agricultural district forming the north of the island, is exported *via* Ramsey. Ramsey is mentioned in the earliest records of the island, and has been the scene of many interesting events in Manx history. The population in 1881 was 4025.

RAMSGATE, a market-town, port, and favourite sea-bathing place of England, in the county of Kent, situated in the Isle of Thanet, 79 miles from London by the South-eastern or London, Chatham, and Dover lines. An excellent harbour has contributed greatly to the prosperity of the town. It is one of the largest artificial havens in England, being formed by two piers, constructed of Purbeck stone and granite, which project from 1500 to 2000 feet into the sea, and inclose an inner basin. This harbour is bordered by wet and dry docks; vessels of 300 tons burden enter it at ordinary tides; a lighthouse stands at its entrance, and it is guarded by batteries. The port has a little coasting trade and fisheries; eggs, fruit, and other provisions from France and Belgium are its chief imports. The old part of the town is in a hollow between two chalk ridges, on which the modern portion is built. There are terraces, crescents, bathing-rooms, assembly-rooms, a handsome modern Gothic church, a small Roman Catholic cathedral by Pugin, and several places of worship for dissenters. St. Lawrence-on-Sea, a beautiful suburb, has some magnificent piles of buildings, forming a hotel on a large scale, and a handsome promenade, winding round the cliffs, beneath which a sea-garden, bazaar, and pretty concert-room were erected in 1877. In 1881 a promenade pier was added to the attractions of the town. The population in 1881 was 22,605, which is of course greatly increased during the season.

The name is supposed to be derived from *Rham*, the British name for Thanet, and *gate*, a passage, from the break in the cliffs in which the old town is built. At Ebbesfleet, now merely a piece of rising-ground separated from the sea by a field and a sea wall, then a promontory stretching into the sea, is the supposed landing-place of Hengist and Horsa in 419, and of Augustine in 596.

RAMSON (*Allium ursinum*), a species of garlic found wild in many parts of Britain, and formerly cultivated in gardens; but its use has been superseded by the *Allium sativum*, a native of Sicily, which is the garlic now in cultivation.

RAMUS, PETER (*Pierre de la Ramée*), was born in Picardy in 1502, according to one account, and in 1515 according to another. His parents were extremely poor, and he was sent when a boy to tend sheep. Having an ardent desire to obtain knowledge, he ran away from his parents to Paris, and at last entered the College of Navarre as a servant. He made great progress in all studies, with very little assistance. When he presented himself for his degree, he undertook as an exercise the daring task of defending the thesis, "Everything that Aristotle taught is false." This was the origin of the anti-Aristotelian doctrines by which Ramus gained his fame. In 1543 he published his new system of logic, with strictures on the logic of Aristotle. The publication of this work exposed him to great obloquy; and the king

ordered his works to be suppressed, and forbade his teaching or writing against the illustrious Greek, on pain of corporal punishment. Ramus availed himself of his leisure to study mathematics and prepare an edition of Euclid. In 1551 he was named by the king (Henry II.) professor of philosophy and eloquence in the College of France. During the next ten years he published a Greek, a Latin, and a French grammar, and several treatises on mathematics, logic, and rhetoric. Ramus, who had embraced Protestantism, brought trouble upon himself by the zeal with which he advocated the new doctrines. Charles IX. offered him an asylum at Fontainebleau, but while he was absent from home his house was pillaged and his library destroyed. He returned to Paris in 1563, and resumed possession of his royal chair. Civil troubles again drove him away from Paris, and in 1568 he went to Germany, and gave lectures on mathematics at Heidelberg, where he made public profession of Protestantism. Shortly after his return to Paris he fell a victim in the massacre of St. Bartholomew.

Although Ramus had many merits as a philosopher, and did good by his opposition to the Aristotelian philosophy, which then held men's minds in bondage, he was wanting in depth and caution, and his strictures on Aristotle are by no means altogether just. He had many followers. France, England, and particularly Scotland, were full of Ramists. Andrew Melville introduced the logic of Ramus at Glasgow. See Waddington-Xastus' "De Petri Rami vitâ, scriptis, philosophiâ" (Paris, 1848); and Charles Desmazes's "Petrus Ramus, Professeur au Collège de France, sa Vie, ses Écrits, sa Mort" (Paris, 1864).

RANCHO (Spanish, "a messroom") is the name given in Mexico and California to the huts used by the herdsmen of the plains. From it is derived the name *ranchero*, which in Mexico is applied to a mixed breed of Spanish and Indian descent, the members of which shun a town life, and adopting the life of stockmen, are famed for their skill as hunters and horsemen, their daring, and powers of endurance. From the ranks of these men are recruited the guerrilla cavalry of the Mexican army. *Rancho* in California is the name applied to the large farms devoted to the raising of cattle.

RANDERS, a port in North Jutland, belonging to Denmark, is situated about 22 miles N.N.W. of Aarhus, with which it is connected by railway, near the Baltic, on the river Guden, which is here navigable. It is a walled town with seven gates, and next to Aarhus is the most considerable place in Jutland, having a population of 9000. The chief buildings are a fourteenth-century church, town-hall, court-house, and a synagogue. The inhabitants manufacture gloves, stockings, woollen cloths, earthenware, beer, spirits, sugar, and lampblack. Shipbuilding and salmon fishing are carried on, and there is a brisk trade in corn. Near Randers is the strong castle of Dronningborg.

RANDIA, a genus of plants belonging to the order RUBRACEÆ. *Randia dumetorum* (bush randia) has a fruit which, when bruised and thrown into water, intoxicates or even kills fish, having the same effect as the *Cocculus indicus*. In the form of powder it is a powerful emetic. An infusion of the bark of the root is employed to produce nausea in bowel complaints. *Randia uliginosa* (bog randia) is a native of the East Indies, in moist places. The flowers of this species render it deserving of a conspicuous place in the hot-house.

RANGOON is a commercial town of British Burma, in the province of Pegu, and is built on the most eastern branch of the river Irrawaddy, about 26 miles from the sea. The city contains a great pagoda, Shwê Dagong, and all along the sides are built a number of *sidas*, or monuments in honour of Buddha. The Shwê Dagong is richly gilt all over. It is 278 feet high, and is surrounded by an inclosure, in which is an immense bell of very rude

fabric. The foundation of the pagoda is said to have been laid 500 B.C. All round the principal pagoda are smaller temples, also richly gilt. The large one, having long enjoyed a higher reputation than any other in the Burmese dominions, is resorted to by numerous devotees.

Rangoon was built by Alompra, after the destruction of Pegu and Syrian, in 1755. It was almost destroyed by fire in 1850. In 1852 it was taken by the British, when it was bombarded from the river. In 1853 it was again destroyed by fire, but has since been rebuilt and very much improved, many substantial houses of brick and stone having been erected by the European inhabitants. It is now fortified in the European style, and has a government naval yard, a new arsenal, and a military magazine. Rangoon has risen to be a place of much commercial importance, and the conquest of Upper Burma by the British in 1886 will no doubt greatly add to its importance. Shipbuilding is carried on to a considerable extent, and in 1866 a floating dry dock was constructed, capable of repairing the largest ships as effectually as in Calcutta. Much commerce is maintained with neighbouring countries, especially with Chittagong, Dacca, Calcutta, Madras, Masulipatan, the Nicobar Islands, and Pulo Penang; there is also some trade with Bombay and the Persian and Arabian Gulfs. The imports are principally British manufactures. When it was taken by the British it had no commerce worthy of the name. The chief exports are teak, rice, catechu, wax, and ivory. Steamers ply up the Irrawaddy to Ava. The climate is healthy, but very damp. The first line of railway constructed in British Burma was opened from Rangoon to Prome, a distance of 150 miles, in 1878. The population of the town in 1881 was 134,176.

RANK AND FILE, a military term which comprises the mass of the army, including all the privates, corporals, and inferior non-commissioned officers. The strength of an army is reckoned by its rank and file, and does not include the officers and sergeants. A rank is a row of soldiers standing side by side, and a file is a line of men standing one behind another.

RANKE, LEOPOLD VON, an illustrious German historian, was born at Wiehe in Thuringia, 21st December, 1795, the eldest of five brothers, three of whom besides himself became professors and men of some mark in the literary world. He commenced life as a student, and then tutor at the college of Frankfurt-on-the-Oder, and in 1824 he published his "History of the Romanic and German Nationalities," and a smaller work, entitled "Criticism on Modern Historians." These works attracted so much attention that it was thought desirable to attract him to the capital, and in 1825 he was appointed extraordinary professor of history in the University of Berlin. In 1829 he was sent officially to examine the public archives accessible to him in Vienna, Venice, Florence, and Rome. He spent nearly four years over this tour of discovery, which marks an epoch in modern study, inasmuch that it not only furnished Ranke with much of the material out of which he subsequently wrote the history of Europe in the sixteenth and seventeenth centuries; but it also indicated to historians the true use of diplomatic documents and other original authorities, and revealed the existence of a mass of matter totally unknown to his predecessors. The first results of his travels and researches appeared in the publication (1827-36) of "The Princes and the Peoples of Southern Europe in the Sixteenth and Seventeenth Centuries," "Conspiracies against Venice in 1688," and "The Popes of Rome, their Church and State." The latter work is justly considered one of the greatest of Ranke's histories, and it is certainly that which has been most widely read in Europe and America. It was translated into English by Sarah Austen, the wife of the great jurist, in 1840, and it was the subject of a brilliant review by Lord Macaulay in the *Edinburgh Review*. In 1839-43 Ranke published

a work which is still more valued by his countrymen, in his "History of Germany during the Reformation," and in 1841 he was appointed historiographer-royal to the King of Prussia, Frederick William IV. To enumerate even the titles of the various works published by him during the remaining forty-five years of his life would require more space than we can command; but it may be mentioned that an incomplete edition issued at Leipzig during his lifetime extended to forty-five volumes. Among the more prominent of them are his "Nine Books of Prussian History," issued in 1847; a "History of France at the period of the Reformation" (1859-62); "History of England, chiefly in the Seventeenth Century" (1859; fourth edition, 1877); "Biographical Studies" (1871); and a "History of the World," bravely commenced at the age of eighty-six, which he lived to complete as far as the period of the middle ages.

During his whole career such honours as are open to scholars were freely conferred upon him by his countrymen and by the learned societies of Europe. In 1860 France chose him foreign member of the Academy in succession to Hallan; in 1865 he was made President of the Historical Commission of Munich; in 1866 he was ennobled by King William II.; and the following year, after the death of Bockh, he was made chancellor of the unimpaired Order of Merit. Later, in 1882, he was appointed Privy Councillor, with the title of Excellency. He died at Berlin on 21st May, 1886.

RAN'NOCH, LOCH, a lake of Scotland, in the county of Perth, with a length of about 9 miles and a breadth of about a mile. Situated in the midst of well-wooded slopes rising into lofty mountains, it forms the centre of most beautiful scenery. Rannoch Moor, in the western part of the district, has the reputation of being the largest and most dreary moor of Scotland. It has a mean level of 1000 feet above the sea.

RAN'ULA, a tumour formed beneath the tongue, and probably resulting from the obstruction of one or more of the ducts of the sublingual salivary glands. It is usually of a rounded form, with a smooth polished surface similar to that of the adjacent mucous membrane. When small, it produces so little inconvenience that it is usually not discovered till it has existed for some time. As they increase in size, however, these growths, though seldom attended with pain, cause great inconvenience, by obstructing all the movements of the tongue. They usually burst when they have attained the size of a walnut, but they sometimes continue to increase beyond this size, and they have been seen large enough to contain a pint of fluid. Where they call for treatment they may generally be cured by taking up a piece of the cyst wall and cutting it off with scissors, or a seton may be passed through the tumour and knotted, when the cyst will gradually contract.

RANUNCULA'CEÆ is an order of plants founded on the common crow-foot or buttercup (*RANUNCULUS*), but embracing a large variety of different structures within its limits. All are more or less acrid or poisonous, and some vehemently so, as aconite and hellebore; others are beautiful with their gay flowers, as the peony, ranunculus, larkspur, and columbine; many, however, are mere weeds. The number of known species exceeds 1000. The following are the chief characteristics of the order:—The sepals are deciduous, usually coloured, generally five in number. The petals are sometimes small or altogether wanting, and of the same number as the sepals or numerous. The stamens are numerous. All these parts are free and hypogynous. There are several one-celled carpels, free from one another or (rarely) somewhat united. The ovules are anatropous. The fruits are achenes. The embryo is very small, in horny albumen. The species are herbs with alternate leaves, or (rarely) climbing shrubs with opposite leaves; stipules are very rare.

RANUNCULUS, a genus of plants, the type of the order **RANUNCULACEÆ**. The species are mostly acrid, and if applied when fresh to the skin will produce blisters: this quality is destroyed by drying or by heat. *Ranunculus aquatilis* (water crow-foot) is native throughout Europe, Western Asia, North Africa, and also in America and England, in pools and stagnant waters. *Ranunculus glacialis* is a native of the higher Alps of Europe, among rocks, near the limits of perpetual snow, and of Lapland and Iceland. *Ranunculus acris* (buttercup) is extremely acrid and dangerous; even pulling up the plant and carrying it to some little distance has produced inflammation in the hand. Cattle in general will not eat it, but sometimes when they have been turned hungry into a field they have fed upon it, and in consequence their mouths have become sore and blistered. When made into hay, however, its noxious qualities are lost. It is commonly called buttercup, under a notion that the yellow colour of butter is owing to these plants. *Ranunculus sceleratus* (celery-leaved crow-foot) is one of the most virulent poisons of our native plants. *Ranunculus Thora* is native of the Alps of Europe. It is said to yield the juice formerly used by the Swiss hunters to poison their darts; wounds from such weapons speedily become fatal. *Ranunculus Ficaria* (pulsatilla) is native throughout the whole of Europe in meadow, bushy places, and about hedge banks; it is plentiful in Britain. A notion that the root is efficacious in the cure of piles gives it its common English name. *Ranunculus arvensis* (corn crow-foot) is native throughout Europe, in North America, and Great Britain. It is very acrid and dangerous to cattle, though they are said to eat it greedily. *Ranunculus asiaticus* (common garden ranunculus) is a native of the Levant. The garden ranunculus is a florist's plant, and has been cultivated with great care. The garden varieties of this species are very numerous, as no two plants produce flowers precisely alike. The chief characteristics are the following:—The sepals are three to five; the petals are of the same number or numerous; the carpels are numerous, each with one ovule, and the ovules are ascending, with raphe ventral. There are over 160 species, native of the whole world, a few being found even in the tropics at the tops of mountains.

RANZ DES VACHES, the name often given to the songs with which the Swiss mountaineers collect their cattle from the mountain pastures, and which are called in the German cantons *Kuhreigen*. Some uncertainty exists as to the origin of the terms *Ranz* and *Reigen*; in all probability the first comes from the Swiss *ranuer*, to rejoice, and the second from *reigen*, a dance accompanied with song.

Each Swiss canton, and often each valley, has its own characteristic *Ranz des Vaches*, irregular and barbarous as the music of the bagpipe, yet charming and full of local colour when heard amidst appropriate natural surroundings, echoed from cliff to cliff. Chest voice and falsetto, melody and floritura (Ger. *jodeln*) being mingled in curious fashion. The following is a specimen of the flourishes which serve as refrains to the songs proper, the lower note being a chest-note and the upper notes falsetto:—



The **F** is flat to the usual pitch; it is in fact the eleventh harmonic on any open pipe, such as the "alpenhorn," on which these melodies are often played.

RAPATACÆE is an order of plants belonging to the **MONOCOTYLEDONS**. At one time this order was placed

among the **Rush** family, but it differs in the perianth, the inner series of which is petaloid; in the anthers, which dehisce at the apex by a long pore; in the seed, the embryo being lenticular and close to the hilum in nearly endosperm; and in the inflorescence, which is a scape bearing the flowers in a terminal head, each flower being surrounded by a collection of bracts like the involucre of Composites. *Rapatea* has yellow flowers and long flat radical leaves. There are six genera, containing twenty species, natives of Brazil and Guiana.

RAPE (Lat. *rapio*, I seize) is defined to be the having unlawful carnal knowledge of a woman by force and against her will. It is a felony, and is punishable by penal servitude for life or for any term not less than three years, or imprisonment for any term not exceeding two years, with or without hard labour, according to circumstances. All persons present aiding, assisting, or encouraging the commission of this crime are held to be principals in the second degree, and punishable accordingly. It is an essential feature of the crime that it be against the will of the sufferer, so that if she be cheated into consent the crime is not committed. Where, however, consent is obtained by threat of murder or violence the crime is held to be rape according to the definition of the law. In the case of a female under twelve years of age, whether the act takes place with or without her consent, it is equally punishable as rape, and if she is over twelve and under sixteen her consent reduces the act to a misdemeanour punishable by imprisonment with hard labour for any term not exceeding two years. The taking or causing to be taken any unmarried girl, under sixteen, out of the possession and against the will of her father or mother or guardian, is also a misdemeanour whether the girl consent or not.

RAPE is an ancient Saxon term for a large division of a county midway between the hundred and the complete shire. In Sussex we have still the Rapes of Bramber, Lewes, &c., which correspond with the Lathes of Kent and the Ridings ("trifling" or third-part) of Yorkshire and Lincolnshire. The word means "share," and comes from the Old English *hryppan*, to seize. In Iceland the territorial meaning still applies, and *hryppur* = district.

RAPE (*Brassica napus*). This plant, which is of the cabbage tribe, is cultivated like cole or colza (*Brassica campestris*), for the sake of its seeds, from which oil is extracted by grinding and pressure. It is also extensively cultivated in England for the succulent food which its thick and fleshy stem and leaves supply to sheep when other fodder is scarce.

The mode of cultivation of the cole and rape for seed is nearly the same. The cole takes a longer time to come to maturity, and produces more seed. The rape grows on less fertile soils, and may be sown in spring as well as in autumn. Both are hardy, and resist the winter's frost. See **BRASSICA**.

RAPHAEL. See **RAFFAELLE**.

RAPIER (from the Spanish *raspadera*, a raker or poker), a sword having a straight, light, narrow blade, generally four-sided, highly tempered and finely pointed, designed for thrusting only. It seems to have been first made in Italy, from whence it passed into France and Spain, and also into England. The first rapiers were fitted with cup guards of open metal work, straight handles, and curved or straight quillons. It was the weapon most used in duelling, and was formerly carried by every gentleman, but it is now worn only on some occasions of court ceremonial.

RAPPAHANNOCK, a river of VIRGINIA, one of the United States of N. America, rises in the Blue Ridge, flows to the south-east, and joins Chesapeake Bay by a large estuary. Its total course is 130 miles, for the last 110 miles of which, from Fredericksburg to the bay, it is navigable. The Rappahannock was the scene of some of the most terrible battles in the American civil war.

RAPPAREES', a term of reproach for certain half-savage Irish blackmailers, freebooters, and cattle-lifters, often armed with the *rapary*, a kind of half-pike, and very troublesome during the seventeenth century, especially during the brief reign and Catholic reaction of James II.

RAPPEE', a coarse kind of snuff, so called because it was manufactured from dried tobacco by means of the *rape* or *raspe*, an instrument used in cutting the thin parts of the leaf from the veins and fibres. Only the latter are employed in making rappee.

RAP'PEN, the Swiss equivalent to the French *centime*, the hundredth of a franc. The old Swiss franc, worth fourteence, was divided into 100 rappens, and the name is still often retained for the piece of lower value. It comes from the figure of a *rahe* (raven), which it bore on its face in early times.

RASHI, a name compounded from Rabbi Shelomoh Juhak, by which one of the ablest and most learned of the Talmudists of the middle ages is generally referred to. His father was probably the rabbi of Troyes in France, and he had gained fame as a learned Talmudist at the time of the birth of his son in 1040. Rashi married at the age of eighteen in accordance with Mishmic precept, but afterwards, with his wife's consent, he left his home and travelled into Germany to pursue his studies at the great rabbinical schools there. He endured with great patience severe privation in order that he might acquire instruction, and improved his opportunities with so much zeal and ability that he was able, in 1064, to return and settle at Troyes, where he opened a school for the study of the Bible and Talmud. His fame as a teacher quickly rose, and he was soon attended by a band of disciples gathered from France and North Germany, for whose instruction he laboured until his death, 13th July, 1105. He was a man of great piety and intelligence, as well as a profound scholar in Talmudic lore, and by the Jews he is regarded as the perfect example of a rabbi. His writings include a commentary on the whole of the Hebrew Bible, with the exception of some portions of Job and the Books of Chronicles; a commentary on the Babylonian Talmud, of which he completed the major portion, but was overtaken by death before he could finish his task; a series of "Religious Decisions," given in answer to questions regarding points of law and practice; and some prayers, one of which is embodied in the additional service of the day of atonement.

As a commentator on the Bible, Rashi stands at the head of the rabbis of the mediæval period, and his works were revered as text-books for many centuries throughout the whole Jewish world, while as a Talmudist he surpassed all his predecessors, and was one of the first who gave elevation and depth to Talmudic study. See "Life of Rashi," by Zunz (1822), and Gratz, "Geschichte der Juden."

RASKOL'NIK is the Russian name for dissenters from the Holy Orthodox Church. They are, of course, made up of various sects, but by far the great majority are religious conservatives of a bigoted type, wedded to the old costume,

the old service-books, and many old half superstitious ceremonies gradually disused by the main body of the church. Up till the present day—and, in fact, even yet more than is openly acknowledged—the Raskolnik have suffered severely at the hands of the orthodox.

RASP'BERRY (*Rubus Idæus*) is a native of Britain and other parts of Europe. The best soil for raspberries is a light rich loam. They will thrive well in sandy peat, provided it is not too dry. In all cases the ground for a plantation should be well drenched and manured previous to planting. Pruning should be performed in autumn. All dead parts must be cleared off, and only a few of the strongest summer shoots retained, and in the next summer they will bear fruit. The ground of a raspberry plantation should be kept loose and supplied with well-rotted manure, but in so doing a fork should be used in preference to a spade. Notwithstanding the best management in these respects, it becomes advisable to make a new plantation in fresh soil after four or five years. The fruit of the raspberry is extensively used in a variety of ways, both by the cook and the confectioner, and also in the preparation of cordial spirituous liquors.

RASP'BERRY VINEGAR, a species of liqueur prepared with raspberry juice, vinegar, and sugar. Very ripe and good raspberries are put into a jar, which is filled up with vinegar; after ten days the vinegar is poured off, and the juice allowed to drain for some hours. The mixture of vinegar and juice thus obtained is added to another jar full of fruit, and treated in a similar manner; the liquid is then gently boiled for about five minutes with its own weight of refined sugar. Added to water it makes a refreshing drink in sickness or in hot weather.

RASSE (*Viverra rasse*) is a species of CIVET (*Viverra*) inhabiting India, Java and the adjacent islands, Hong-Kong, &c. It is distinguished from the other civets by its smaller size and elongated, slender body. The length of the body is nearly 2 feet, exclusive of the tail, which measures some 15 or 16 inches. It is of a tawny-gray colour, with eight longitudinal black bands running along the back and the sides, marked with black spots; the tail is ringed with black and light gray. The rasse possesses the carnivorous habits of its family in a high degree, prey-



The Rasse (*Viverra rasse*)

ing on small mammals and birds, and often working great devastation among poultry. In China the fur is valued for lining to greatcoats. The Chinese also eat the flesh,

although it is so tainted by the musky odour of the secretion of the anal pouch as to be unpalatable to Europeans. In Java this secretion forms a favourite perfume among the natives. In India the *rasse* is often domesticated.

RASTADT, a town of Germany, in Baden, with 14,000 inhabitants, is situated on the river Murg, near the right bank of the Rhine, at a distance by railway of 14 miles south from Carlsruhe, and 26 north by east from Strasburg. It has wide streets and is regularly built. Among the public structures is a fine palace, modelled on that of Versailles, and till 1771 the residence of the Margrave of Baden. There are churches, chapels, a lyceum, and a training school for Catholic schoolmasters. Starch, snuff, tobacco, chicory, papier-mâché articles, fire-arms, mathematical and philosophical instruments, and carriages are manufactured. Rastadt has a strong fortress, and has been the scene of important negotiations. On 6th March, 1714, Prince Eugene and Marshal Villars signed a treaty of peace in this town, which put an end to the War of the Spanish Succession. On the 9th of December, 1797, a congress was assembled here to negotiate a peace between France and the German Empire. Roberjot and Bonnier, the French ambassadors at this congress, were murdered on their way home, at about 500 paces outside the town: no satisfactory evidence was ever obtained respecting the authors of the crime. During the rebellion in Baden in 1818, the republican insurgents having suffered various defeats from the auxiliary Prussian troops, shut themselves up in Rastadt, which, after about a month's siege by the Prussians under the Prince of Prussia, surrendered unconditionally, 23rd July, 1849.

RAT is the common name given to some of the larger species of the Murineæ, a subfamily of the larger rodent family MURIDÆ, the smaller species being known as mice. [See MOUSE.] There are two well-known species of rats found in Britain, the Black Rat (*Mus rattus*), and the Brown Rat (*Mus decumanus*). The black rat is often called the Old English Rat, but it is not a true native of this country, and was introduced probably from France. Its original home is thought to have been Southern Asia, whence it spread into Europe. It was, however, the common species in England before it was displaced by its more powerful cousin the brown rat. This latter species has got the name of the Norway Rat, though it is certainly not a native of that country, but was introduced into England and Europe in merchant-ships from its native land, which is probably India; it was introduced into Australia and New Zealand, and has multiplied in those colonies to such an extent as to be a serious pest. The black rat is a smaller, weaker animal than the brown rat, seldom exceeding about 7 inches in length. The head is more slender, the snout more prominent, the ears larger, and the tail longer than in the common species. Its colour is black, lighter on the belly. A variety known as the Egyptian Rat, found in tropical countries, is distinguished by the grayish colour of its upper parts, the belly being white. The black rat has been almost exterminated in England by the brown rat, and is now seldom seen in this country. It haunts the upper parts of houses in preference to cellars, &c. The common brown rat is too well-known to need a detailed description. It grows to a length of 8 or 9 inches, and has small ears, and a scaly tail less than the body in length. The general colour is grayish-brown, becoming white on the belly; the ears, feet, and tail are flesh-coloured. Its general habits are well known. It is omnivorous in its diet, and in this way undoubtedly confers great benefit on man by devouring all sorts of garbage, which, if left to decay, might produce fevers, &c. On the other hand, it does great damage in barns and storehouses, and by its burrowing habits often undermines the foundations of buildings. Its

ferocity is notorious, and its sagacity is no less remarkable. Its fecundity is enormous. It begins to breed as early as fourteen weeks old, and can produce six or seven litters a year; from four to fourteen young are produced at a time. Though naturally of a savage disposition, rats may be tamed and taught many amusing tricks.

The means to be employed for destroying these pests are various, such as traps, poisons, or dogs or ferrets. The use of poisons is objectionable, as the instinct of the animal leads it to choose to die in privacy, so that it retires, if possible, into its hole, and, when dead, revenges itself on its enemy by poisoning the air around. The best method is to get rid of them in a body by making their usual haunts unpleasant for them. This may be done by smearing their holes with tar, which sticks to their fur, and the smell of which they dislike. Another plan is to catch a rat and cover its body with tar or turpentine, and then let it loose. When traps are set, they should be left open for a time, and the rats allowed to go in and out without hindrance, till they crowd together in them, and can be taken in great numbers. When rats have been caught in a trap, and have soiled it with their excrements, it should not be washed, nor much handled; it should be left in the same spot as long as any rats are caught. Any change of position excites their caution.

A great number of other rats are found in various parts of the world. Among these the Tree Rat (*Mus arboreus*) of Bengal is interesting on account of its arboreal habits, climbing trees to feed on young cocoa-nuts, and making a nest in the branches. The Florida or Wood Rat (*Neotoma floridana*) is common in the United States, and resembles the brown rat in size and colour. Its habits vary in different localities. It feeds on grain, seeds, and fruits, and also on frogs, &c. Other rats of the same and allied genera are also found in North America.

RATAFYA (French), a cordial prepared by flavouring an alcoholic liquor with the juice of some fruit, and sweetening it with sugar or syrup. It is also the name for a spirituous liquor consisting of brandy flavoured with the kernels of apricots, cherries, or peaches, and for a special liquor manufactured at Dantzic.

RAT'ANY, RHAT'ANY, or RATANHI'A, is the *Krameria triandra* of botanists, a plant belonging to the order POLYGALÆE, or Milkwort family. It is a half-shrubby plant found on the dry gravelly soil of Peru. The root is excessively astringent, and is exported to Europe on that account. It is used medicinally in this country as an astringent medicine in passive bloody or mucous discharges, weakness of the digestive organs, and even in putrid fevers. Its powder, mixed with charcoal, forms excellent tooth-powder. An acid obtained from it is known to be used in the adulteration of port wine.

RATE, an assessment levied by authority upon property. Rates are of various kinds, and are denominated with reference to the objects to which they are applied.

The nature of church-rates is explained under CHURCH-RATES; and rates for the relief of the poor are fully described in the article on the POOR LAWS. The subject of county-rates is explained under COUNTY-RATE.

RAT'EL (Mellivora) is a genus of carnivorous mammals belonging to the subfamily MUSTELIDÆ. There are two species of ratels or honey-badgers, as they are often called, the African Ratel (*Mellivora capensis*), occurring in South Africa and in other parts of that continent, and the Indian Ratel (*Mellivora indica*), found all over India. These two species agree closely in appearance and habits. The ratel has a stoutly built body, about 30 inches long, exclusive of the short tail, which is 5 or 6 inches in length. The limbs are short, semi-plantigrade, and provided with five toes; the claws, especially those on the front feet, are long, curved, and strong, admirably adapted for burrowing. The head is stout, smooth, and short, and the ears are very

small. The teeth are thirty-two in number, there being only one molar on each side in each jaw. The body is covered with stiff wiry hair, ashy-gray on the upper surface, black on the under surface; the muzzle, limbs, and the under side of the tail are also black. A distinct white line in the African species separates the gray of the upper surface and the black of the under. The skin is thick and

very loose. The ratel lives in burrows, in which it lies concealed during the day, issuing forth at sunset in search of food, which consists of rats, birds, insects, and worms. The African species is said to live largely on honey, tearing up the bees' nests with its strong claws; in search of this food it is said to follow the Honey-guide (*Indicator spurmanni*), a bird which also lives on honey. The Indian



The African Ratel (*Mellivora capensis*.)

ratel has a worse reputation, for it is said to be very destructive to poultry, and even to dig up dead bodies.

RATHLIN', ISLAND OF, an island on the north coast of Ireland, in the county of Antrim, about 5 miles long by $1\frac{1}{2}$ broad, 9 miles from Giant's Causeway. It has a good harbour and anchorage on the south-west side, and in the interior good pasturage. There are magnificent basaltic cliffs, with columnar ranges, based on some parts on a stratum of white chalk, as on the mainland opposite. On its east side are the remains of Bruce's castle, where the exiled patriot resided after the successes of Baliol, and which is said to have been the scene of the well-known incident of the spider and the web. The area is 3398 acres.

RATICHIUS is the Latinized form of the name of a certain *Ratich*, whose educational theories created a great stir in their time. Ratich was born at Wilster in Holstein in 1571, was educated at Hamburg, studied at Rostock, and was only prevented from taking orders by a defect of speech. Having elaborated a scheme of teaching, whereby he professed to be able to teach any known tongue to any student in six months and with very little study, he travelled with it to England, and thence to Holland, offering his services and his method to princes and to universities. In Holland Prince Maurice would have engaged him if he would have undertaken the teaching of Latin, but he declined to confine his exertions to so narrow a field. In 1612 he met and convinced the electors of Germany, assembled in diet at Frankfurt, and a commission of learned men investigated his system. Influenced by their report the town of Augsburg engaged him to remodel their schools in 1614. He was not very successful, but had done enough for the princes of Anhalt-Köthen and of Weimar to establish him at Köthen in 1619, with schools and teachers at his command, and printing presses to print his books secretly. He got together 230 boys and 200 girls, swore them all to secrecy, as well as his teachers, and set to work. In those days, however, religious feeling ran high. Ratich had promised to introduce a uniform religion, as

well as many other benefits, but he started by teaching uncompromising Lutheranism. This set Calvinistic Köthen by the ears. His classes, hardly well begun, were suspiciously examined, and were not found to satisfy the examiners' hopes. Of course this was very unfair, because Ratich was working professedly on a new system, and ought to have had his full stipulated time before he was tested. It was enough as a pretext, however. He was thrown into prison as an impostor, and contemptuously dismissed in a few months. He never again got a fair chance of trial, and died in 1635, still protesting his power to do miracles in the way of teaching.

Yet Ratich was no quack. His methods are remarkable for his age, so far as we know them. These are his maxims, and they are unimpeachable:—(1) Everything must follow the order of nature; (2) one thing at a time; (3) one thing again and again repeated; (4) nothing by rote; (5) uniformity in all things; (6) knowledge of the thing before knowledge of its details and properties; (7) everything to be evolved by experiment; and (8) everything without coercion, since the mind best retains what it finds pleasure in receiving. The main points of the method as to language resembled that of Roger Ascham: for instance, in Latin the pupils took a play of Terence, and first learned the translation well, then they took the Latin original, and worked at it with the master translating to them. After this the master translated a piece first, very carefully, and the pupils then translated the same piece; in subsequent lessons the pupils translated the same piece alone. Then sentences were made from the translation with case and tense altered, &c., and a counter-translation into Latin thus made. In this way, going over one small book many times, undoubtedly a real knowledge of the main points of the language and its grammar would be firmly and intelligently grasped. The method fails in the inevitable tedium of the first study of the translation, in the working the whole book through, instead of mastering it by successive portions, and in not using the important

element of writing. Still the grand secret of setting pupils to acquire a thorough mastery of one book, to which, as a criterion, the whole language may be referred, was undoubtedly advocated by Ratich, and although Roger Ascham had been before him in this, there seems no reason to doubt but that it was an independent and original discovery.

RATIO. This term is best explained by the synonym *Relative Magnitude*. Thus, in saying that the ratio of 2 to 4 is the same as that of 3 to 6, we say that 2 is relatively to 4 what 3 is relatively to 6. The ratio of one number to another is expressed by the fraction which the first is of the second. Thus the ratio of 4 to 7 is expressed by the fraction $\frac{4}{7}$; 4 is $\frac{4}{7}$ of 7; that of 8 to 12 is most simply expressed by the fraction $\frac{2}{3}$.

RATIOCINATION, or the act of reasoning, consists of the comparison of several judgments with the view to form by their combination a new judgment; or, as it is otherwise expressed, it is the drawing of a conclusion from certain given premises. Just as a judgment is arrived at by a comparison of simple conceptions, so is a conclusion arrived at by the comparison of judgments. The latter process, though, as is plainly evident, it is merely an extension of the former, is specially indicated by the term ratiocination. It is a higher and more complex process of assimilation or classing; differing from *perception* (the recognition of a single object) and from *conception* (the assimilation of many objects) inasmuch as it is the assimilation of things in their connection with certain other things, or, briefly, the identification of relations among things. The perception of the bond of similarity is the essential point in a process of reasoning; the perception of difference, though necessary to the process, for the avoidance of error, yields no uniting link which enables the new judgment to be arrived at. Thus, if A and B are both equal to C, we can form the conclusion that they are equal to one another; but if they are both unequal to C we can form no conclusion from that as to their relations to each other.

Although every act of ratiocination when examined falls properly into the form of the *syllogism* [see LOGIC], and in that form is best able to be rigorously tested, it would be a great error to suppose that we reason syllogistically in an ordinary way. In point of fact a little careful observation of our own mind will show us that we habitually "jump at conclusions," and only when the conclusions are challenged do we form and examine the premises. The rustic whose experience of many unsupported bodies is that they fall, will not believe that the balloon which he sees being inflated will presently rise and float; but he does not consciously say to himself "all unsupported bodies fall," until his observation of the balloon or the remark of a bystander causes him to examine the grounds upon which he has based his conclusion that the balloon if raised into the air will fall. The analogies of ships and other bodies which float in water then readily occur to him, and show him the incorrectness of his assumption that all unsupported bodies fall; or, further, he may see the balloon is, strictly speaking, not an unsupported body, if it be able (as he soon finds that it is able) to float in air as the ship floats in water, and therefore both ship and balloon will be accurately described rather as supported bodies than as unsupported. The chief benefit of some acquaintance with logic lies in the greater habit of correct ratiocination which it gives, and the consequent checking of our constant "jumping at conclusions," drawing inferences from a few particular instances, and constructing hasty generalizations.

RATIONALISM, a term used in England in a wide and general sense to denote a tendency in theological reasoning which leads men on all occasions to subordinate dogma and authority to the dictates of reason and conscience, which are made the ultimate test of religious truth, and in a narrower sense to designate a definite school of

theological thought which arose in Germany in the eighteenth century, and which has in the present century been superseded by other schools. In Germany only the limited sense of the term is recognized, and the present article will deal only with the historical portion of the subject. At the time the English school of deists, and Voltaire and other writers in France, abandoned Christianity and endeavoured by their writings to undermine its foundations, Reinmarus of Hamburg, a German who adopted similar views, endeavoured to show the improbability and impossibility of revealed religion, and more especially to prove that the books of the Old and New Testaments were not of divine origin. The publication of these opinions in the celebrated "Wolfenbüttel Fragments," which were issued by Lessing after the death of Reinmarus, created an extraordinary sensation among German divines. The majority remained faithful to their belief; but another class, though opposed to the views of the deists, struck out a middle path. These were the Rationalists, who denied the divine origin of the Scriptures; but they dissented from the deists, who affirmed that the Bible was the product of fraud, and they maintained that, notwithstanding all the apparent incongruities of the Bible, it was based on historical foundations, to ascertain which was the problem of reason. The authors of the biblical books, according to the Rationalists, were not impostors, but men of moral purity, who, being deluded by their imagination, considered things to be miraculous which were natural occurrences. Other portions of the Bible, they said, which have hitherto been considered as recording supernatural events, need only to be divested of the figurative mode of expression peculiar to all Eastern nations, in order to appear as the records of ordinary occurrences. This mode of interpretation was the more readily adopted by many theologians, as it had been and was then still applied to the stories of heathen antiquity.

The theologians who first came forward as advocates of this new system were Semler, J. D. Michaelis, and J. G. Eichhorn. They directed their attacks against the deists as well as against the orthodox divines, but they confined the application of the rationalistic principle chiefly to the books of the Old Testament. The chief writer of this school was Semler, a man of great piety, learning, and ability, who is called by his countrymen the father of modern Biblical criticism.

Another able rationalistic writer was Dr. Paulus of Heidelberg; and it is he perhaps who most completely developed the whole system of rationalism. Paulus first insisted upon the necessity of distinguishing between those passages of the Bible in which the writers simply state facts and those in which they give their own opinions of them. A fact, according to him, was that which the writers describe as having taken place within their own experience; an opinion was the manner in which they interpret an occurrence, and trace it to what they conceive to be its cause. But as these two elements are in most cases mixed up with each other in the biblical writings, Paulus conceived it to be the chief object of the biblical critic to separate them, and to discover the genuine historic truth in the various disguises with which the opinions of the age and of the writer have surrounded it; and he thought, with Eichhorn, that this object may be accomplished if the critic transported himself as much as possible to the scene of the events, and supplied such accessory and explanatory circumstances as may have been neglected or overlooked by the reporter or eye-witness.

A reaction manifested itself during the first ten years of the present century. The consequences of the French Revolution created a general desire to return to the religious and political institutions of past times. But this reaction had very little effect in theology, as it manifested itself rather in passive and retired mysticism than in energetic efforts against the rationalists. A vigorous oppo-

sition, however, began in 1810, by the publication of Reinhard's "Geständnisse," in which rationalism and supernaturalism were declared to be utterly irreconcilable with each other. The contest which then commenced was carried on in a calm and philosophic spirit till 1817, when the centenary anniversary of the Reformation was celebrated in Germany, and the supernaturalistic party, headed by Dr. Harns of Kiel, endeavoured to make the question a practical one, and to draw to it the attention of the governments and of the whole German nation. The rationalists were now universally decried as infidels; and innumerable works were written by the theologians of both parties to defend their opinions. In these controversies the rationalistic theory itself almost disappeared, and the question assumed the more general character, whether the Protestant church should allow freedom of thought or not. This turn of the question induced many of the moderate supernaturalists, who could not sacrifice their liberty of conscience, to side with the rationalists. Their wish, however, was merely to bring about some kind of a reconciliation, and not to allow the question to become a national one. Their opinion was that it should be kept strictly within scientific limits, and confined to the learned. Although willing to make concessions to the rationalists on many points, they were yet anxious to prevent any practical innovations.

After this fierce contest, which led to no decisive results, a complete indifference prevailed, and all hopes of producing any definite result seemed to be given up. Each party, however, continued to maintain its tenets, but the view which the rationalists had taken of the Scriptures contained some elements which led in the end to a fresh crisis in German theology, and the enunciation of theories alike fatal to the positions taken up by the supernaturalists and rationalists. Some parts of the Scriptures, from which the rationalists saw no hope of eliciting a genuine history, they had declared to be a mere legend or mythos. The profound investigations into ancient profane history had led to similar results in other departments, and the rationalists now began to apply the principle, to which they had formerly recourse only in cases of extreme difficulty, to the whole body of the early and miraculous portions of the Scriptures, which they placed on the same footing with the fabulous stories of ancient Greece and Rome.

Up to the year 1835 this second form of rationalism had been applied only partially, and chiefly to portions of the Old Testament; but it was carried out in its full extent with reference to the books of the New Testament, by Dr. David Friedrich Strauss, in his life of Jesus, "Das Leben Jesu kritisch bearbeitet," in two vols. (1835). This work, the production of a man of great learning, profound reflection, and critical skill, called forth a host of polemical works; but rationalism in its first form received its deathblow from this work and the various controversial writings of Strauss and others. As early as 1828 Dr. Pusey, in his review of German theology, informed his English readers that the influence of the rationalistic school was passing away, and though some of its representatives continued to defend their chief propositions a few years longer, it soon became apparent that they were no longer tenable. It is true that the mythical theory of Strauss has proved to be as short-lived as most of those propounded by the rationalist critics, and that it was ultimately abandoned by its author; but the progress since made in the critical study of Jewish and Christian history, and of the books of the Old and New Testaments, has moved the controversy into fields quite unknown to the rationalists and their opponents.

See Pusey, "Historical Inquiry into the Causes of the Rationalist Character lately predominant in the Theology of Germany" (1828); Tholuck, "Vorgeschichte des Rationalismus" (1853-61), and "Geschichte des Rationalismus" (1865); Hurst's "History of Rationalism" (New

York and London, 1866); and Lecky's "History of Rationalism in Europe" (London, 1865; fourth edit. 1870).

RATISBON (*Regensburg*), the capital of the Upper Palatinate, in Bavaria, is one of the most ancient towns in Germany, having been built by the Romans, by whom it was called *Reginnum*, *Castra Regia*, and subsequently *Augusta Tiberii*. In the second century it was already a place of trade. Before the time of Charlemagne, and long subsequently, it was the chief town in Bavaria, and governed by counts of its own under the immediate protection of the German kings. It was made a free imperial city about 1200. The Roman Catholics here formed a league against the Protestants in 1524. At a Diet held here on 1st August, 1806, the German princes seceded from the German Empire, and placed themselves under the protection of Napoleon. It was ceded to Bavaria in 1815.

Ratisbon is situated in an extensive and fertile valley, on the right bank of the Danube, opposite to its confluence with the Regen. The Danube here forms two small islands, called Oberwörth and Niederwörth, which are connected with each other and with the banks of the river by a remarkable stone bridge, 1100 feet in length and 23 feet wide, which was built in the years 1135-10, and connects Ratisbon with its busy trading suburb Stadt-am-Hof, on the left bank. The town is entered by six gates, and surrounded with ramparts, but the ditches have been filled up. Most of the houses are built of stone; they are very old fashioned, and their great height adds to the gloominess of the streets, which are narrow and crooked, but clean and well paved. The most remarkable buildings are the ancient bath-house, in which the German Diet held its sittings; the old episcopal palace; the Gothic cathedral, restored in 1864, one of the finest in Germany, within the large precincts of which are two older cathedrals, one now called the Baptistery, and dating from the tenth century; the other in the form of a basilica, and dating from Roman times, the Scotch Benedictine Church of St. James; and the churches of the ancient abbeys of Niedermünster and Obermünster. There are, besides the cathedral, numerous churches and chapels. In addition to the library in the town-house, there are some other considerable libraries and collections of works of art; also an observatory, a lyceum, a botanical garden, a Catholic and Lutheran gymnasium, an ecclesiastical seminary, a school for the blind, and a school of design. There are extensive bleach-grounds and breweries; and manufactories of leather, tobacco, wax candles, soap, cutlery, earthenware, porcelain, fire-arms, and carriages. Boat-building is also carried on, and there is a considerable trade in salt, timber, corn, and local manufactures. The population in 1880 was 34,156, of whom two-thirds were Catholics and most of the rest Lutherans. Ratisbon is 67 miles N.E. of Munich, and is on the railway from Nürnberg to Vienna.

Near the city is a monument, erected in 1817, in honour of Kepler, who was born here; and on a rock above the Danube, 6 miles below Ratisbon, stands the Wallhalla, a marble temple of the Doric order, erected on the plan of the Parthenon of Athens, by King Ludwig of Bavaria, in honour of the great men of Germany. It is a magnificent and imposing structure, and the interior is as rich as coloured marbles, gilding, and sculptures can make it.

RATITÆ is one of the great groups into which BIRDS are divided. All living birds belong either to the *Carinata*, which have the sternum or breastbone provided with a keel for the attachment of the pectoral muscles which subserve flight, or to the *Ratitæ*, which have a raft-like sternum without a keel, and therefore are unable to fly. The group *Ratitæ* contains only a single family, *STRUTHIONES*, of which the ostriches and rheas are examples.

RATTAN' CANES. See *CALAMUS*.

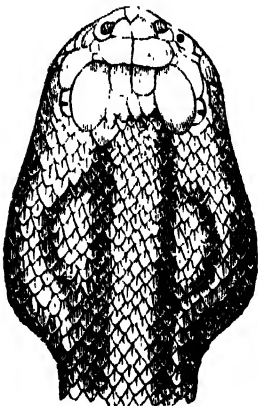
RATTLE (*Ithanthus*, from Gr. *rhin*, a snout, and *anthos*, a flower) is a genus of plants belonging to the

order SCROPHULARIACEÆ. The species are annuals, inhabiting marshes, and confined in their geographical distribution to Europe.

Rhinanthus crista-galli (cocksecomb, or common yellow rattle) has the name of yellow rattle from the colour of its flowers and the rattling noise made by the seeds in the capsule when ripe. On this account the fruits are called rattle-boxes in Ireland. In some parts of England this plant is known by the name of pennygrass, and in Yorkshire it is called henpenny, from the seed-vessels resembling in shape and size a silver penny. The term cocksecomb has been applied to it from the fringed appearance of the bracts which surround the flowers. The seeds of a species of *Rhinanthus* were at one time used in infusion for destroying vermin in bedsteads and furniture.

RATTLESNAKE (*Crotalus*) is a genus of venomous snakes belonging to the Crotalidæ or Pit Vipers, a family distinguished from the true vipers (Viperidæ) by the presence of a deep depression on both sides of the face between the eyes and nostrils. The rattlesnakes have a large head, broad, triangular, and flattened, with the front part above covered with small shields. The body is long and robust, the back and tail being scaly, and the belly covered with broad shields. The tail is short and thick, and terminates in a horny "rattle," which is developed from the simple conical scale which forms the extremity of the skin of the tail in the vipers and other snakes. The rattle is supported internally by a single conical and compressed bone, formed of the last caudal vertebrae, from three to eight in number, which are coalesced and enlarged. This bone is covered by a thick spongy skin which secretes the rattle. This organ consists of a number of dry, horny loosely articulated segments, each of which consists of three rings; but only one of these rings is visible, as the other two fit

loosely into the succeeding segment. The whole rattle is tapering, the oldest and smallest joint being at the end. When the animal violently shakes its tail, the points of the rattle rubbing against one another produce a sharp sound, which has been likened to that of a large grasshopper, and which is perceptible at a distance of from 10 to 20 yards. The number of joints should indicate the number of moults the animal has undergone, but the terminal joints are often worn in time and lost; the largest number is about twenty.



Head of Rattlesnake.

The function of the rattle is not quite clear. The supposition that it has been developed to warn the animal's prey of the danger may be dismissed at once; for special structures are developed for an animal's own benefit, not for its injury. It is more probable that the sound denoting the proximity of a terrible enemy has a paralyzing effect, so that the terrified victim is deprived of the power of escape. This latter supposition is rather confirmed by the general sluggish habits of these animals and the slowness with which they make their attack.

The Common or Banded Rattlesnake (*Crotalus durissus*) has the widest range of these snakes, being found throughout the United States from latitude 40 degrees on the Mississippi to the Gulf of Mexico; it is now, however, rare in the Northern States, except in rocky and uncultivated places. It is usually from 4 to 5 feet long and 6 to 7

inches in diameter. The general colour is ashy, with irregular transverse dusky bars confluent near the tail; there is a yellow line along the back, and the sides are tinged with the same colour. The neck is much contracted and covered with large keeled scales; the eyes are very large and brilliant. The tail is short. It feeds on rabbits, squirrels, rats, &c. It is very sluggish in its habits, and does not strike unless coiled, and then only when molested. Pigs attack and devour great numbers, being protected from the poison by the thickness of their skin and the subjacent layer of fat. The deadliness of the poison, which is emitted from a pair of large perforated poison fangs seems to vary at different seasons of the year, being most fatal in the summer. The Horrid Rattlesnake (*Crotalus horridus*), a larger species inhabiting dry rocky elevated regions, extends from Paraguay and Chili through Brazil into Mexico. It agrees generally with the former species in appearance and habits. The Diamond or Water Rattlesnake (*Crotalus adamanteus*) is the largest species, growing to a length of 8 feet. It abounds in damp dark places in the neighbourhood of water, and is found from North Carolina to East Florida. The Ground Rattlesnake (*Crotalophorus miliaris*) belongs to a nearly allied genus, distinguished by having the upper side of the head covered with nine large shields, and by having a smaller rattle. It is a small species, from 16 to 18 inches long, and is common in the Southern States of the Union, living among leaves and grass, and feeding on field mice and small birds. Its bite is not fatal to man. Another small species of this genus, the Prairie Rattlesnake (*Crotalophorus teremimus*) is the species commonly found in the burrows of the Prairie Dog (*Cynomys ludoviciana*).

RAVAILLAC, FRANÇOIS, the assassin of Henry IV. of France, was born at Angoulême in 1578. He entered the order of the Feuillants, who, however, expelled him as a visionary. He conceived an especial hatred against Henry IV. as the former leader of the Huguenots, and determined to murder him. On the 14th of May, 1610, the king was proceeding in his carriage along the Rue de la Ferronnière, when it was stopped by some waggons. Ravalliac, stepping on the wheel of the carriage, stabbed Henry twice to the heart, and death was instantaneous. The assassin was captured with the knife in his hand. He was put to the torture, but declared that he had no accomplices. Great suspicion of the queen and of the Jesuits prevailed at the time; but recent historians have come to the conclusion that the real cause of the crime was fanaticism degenerated into monomania. Ravalliac was put to death in the Place de Grève, on the 27th of May, 1610, his execution being attended with many horrible circumstances.

RAVELIN, a work constructed beyond the main ditch of a fortress, and in front of the curtain between two bastions. It usually consists of two lines of rampart, which meet in a salient angle on a line drawn perpendicular to and bisecting the curtain. The ravelin was probably first constructed in the place of the more ancient barbican by the Italian engineers of the sixteenth century. Its original name, *riuellino*, indicates a derivation from *regliare*, to watch; and both by Maggi (1581) and Enard (1591) *riuellino*, or *ravelin* and bastion, are used as the names of a work beyond the walls of a fortified place. A semicircular form was very frequently adopted for a work so situated, and this circumstance may have given rise to the name of demi-lune, or half-moon, by which even now the ravelin is often designated. See FORTIFICATION.

RAVEN (*Corvus corax*) is a well-known bird belonging to the Crow family (Corvidæ). The raven is the largest and most powerful of the British species of this family, the adult male measuring about 26 inches in length, and having an expanse of wing considerably over a yard. It has a long and strong bill of a black colour, and the feathers, springing from the base of the upper mandible

and covering the nostrils, are about $1\frac{1}{2}$ inch long. The whole of the plumage is black, with a purple or bluish gloss; the irides are brown and gray and the feet black. Pied and even pure white varieties sometimes occur. This bird is found in all parts of the northern hemisphere, extending its range even into the frozen regions of the Arctic zone: in Sir George Nares' Arctic expedition a pair were observed to breed as far north as lat. $81^{\circ} 41'$ north. In Asia it extends down to Northern India, but is not found in China or Japan. It ranges all over North America, but is not common of late years in the eastern states of the union. In England it has become very scarce through the persecution which it has brought on itself by its predatory habits. It is almost indiscriminate in its diet, preying upon small mammals, birds, reptiles, and insects, plundering birds' nests of their eggs, devouring carrion, and feeding also on grain and fruits. It is notorious for attacking the sick and young individuals of larger mammals, such as sheep. Its intense black colour, its hoarse croak, and the boldness and sagacity it evinces,



have conspired to make the raven a bird of ill omen among superstitious people. Nevertheless it is often kept in confinement, and makes a very amusing pet in spite of its love of mischief. The raven breeds in this country as early as January or February. Its nest is built on a forked branch of a very high tree, or on a ledge of a cliff near the sea, and is composed of sticks and lined with wool and hair. The same nest serves, with a little repair, for several seasons. The eggs are from five to seven in number. In Africa five or six nearly allied species occur, two of which are found also in Asia.

RAVENNA, an ancient city, once a seaport, but now 5 miles from the Adriatic, is situated 18 miles north-east from Forlì and 30 miles north-west from Rimini, in a marshy plain covered with ruins. Between the town and the sea is a fine forest of pines, which extends about 25 miles along the sea-coast. It supplied timber for shipbuilding in the time of the ancient Romans, under whom Ravenna was the chief port of the empire on the Adriatic.

The see of Ravenna was founded by St. Apollinaris, a disciple of St. Peter, in A.D. 44; it was raised to the dignity of an archbishopric in 439. The cathedral, founded in the fourth century, but since that time almost completely rebuilt, has some fine pictures by Guido, and retains several sculptures and other remains of its early age: the baptistery, detached from the church, is still in its original state. The churches of San Vitale, San Giovanni-Battista, and San Giovanni-Evangelista are very ancient structures,

and contain many interesting antiquities, paintings, and mosaics relating to the Emperor Justinian and the Greek exarchs. The mausoleum of Theodoric, outside of the town, has a monolithic dome, nearly 100 feet in circumference, which has been transformed into a church, called Santa Maria-Rotonda. There is a portico, supported by eight granite columns, and other remains of the splendid palace of Theodoric, which was inhabited after his time by the exarchs. The Church of St. Apollinaris-in-Classe, so called because it was built on the site of the old port, is a magnificent structure, raised also by Theodoric, with twenty-four large columns, each of a single piece of marble, which were brought from Constantinople; and a fine mosaic, representing a view of Ravenna in the sixth century, with numerous figures of saints. The great altar is made of porphyry, verde antico, and Oriental alabaster; and the pulpit, which is of marble, is of curious workmanship. Ravenna, next to Rome, is the city of Italy which abounds most with valuable and rare marbles from Greece, Asia, and Africa. The Church of St. Apollinaris contains the tombs of many of the old archbishops of Ravenna, and a series of their portraits. The city has a great number of other remarkable churches, all adorned with rich marbles, valuable paintings, mosaics, and sculptures. In the Church of San Francesco are the tombs of the Polenta family. Among the other remarkable structures are the archbishop's palace, in which is a chapel unaltered since the fifth century, several other palaces, the museum, hospital, and theatre. The six gates of the town, and the public squares, most of which are adorned with several columns surmounted by statues, are also worth notice.

The public library of Ravenna contains 50,000 volumes and 700 MSS. There is also a cabinet of ancient medals and inscriptions, and a gallery of paintings. In honour of Dante, who died at Ravenna in 1321, and whose remains lay in the Church of San Francesco till 1482, a mausoleum was erected in the year last mentioned by the father of Cardinal Bembo. It is a small square building, containing a sarcophagus of Greek marble, in which the poet's ashes rest. The building was repaired in 1692, and again in 1780. Among other objects of interest in Ravenna are—the tombs of the Empress Placidia, of Honorius, and Valentinian III., all richly ornamented with mosaics; the communal hall; a college: the academy of fine arts; the leaning tower; the fortress; Byron's house; and a pillar, outside the city, which commemorates the death of Gaston de Foix, and the victory of Louis XII. of France and the Duke of Ferrara over Pope Julius II. and the Spaniards.

The city is about 3 miles in circumference, and its population in 1881 was 60,573. It has a dull antiquated appearance, but there are some manufactures of silk, linen, paper, glass, and kitchen utensils; and a trade in wine and agricultural produce, which is facilitated by a canal connecting its port with the Adriatic.

Ravenna was founded by Greek colonists, and fell under the Roman power about B.C. 234. In the time of the empire its port became one of the two great stations for the Roman fleet, Misenum being the other. After the separation of the eastern and western empires, Ravenna attained its greatest importance; and Honorius made it the metropolis of the Western Empire about 404. After the fall of the empire, Theodoric the Goth made it the capital of his kingdom. When Narses, having overthrown the Goths in 553, was appointed, by Justinian, exarch of Italy, he fixed his residence in this city, which continued to be the centre of the imperial administration in Italy till the Longobards took it in 752. In subsequent times the archbishops of Ravenna appear to have had the civil administration of the town and its territory. In the middle ages it became a republic, and had its factions, which were headed by two powerful families, the Traversari and the Polenta. Towards the close of the thirteenth century the

latter expelled the Traversari, and usurped the supreme power, which they held till 1440, when the Venetians took the town. By these it was kept till 1509, when it was taken by the French. On 11th April, 1512, the French army under Gaston de Foix fought a desperate battle near Ravenna against the Spanish and Papal troops. The French won the battle, but lost their commander, and soon after they were compelled to retire from Italy. By the treaty of Bologna in 1530, Ravenna and its territory were given up to the Pope. Since 1860 it has been included in the kingdom of Italy.

RAVENSCROFT, THOMAS, was born in 1592, educated in St. Paul's choir, and admitted to the degree of Bachelor of Music by the University of Cambridge, in 1602. In 1609 appeared two compilations by Ravenscroft—the first called "Pammelia: Musickes Miscellanie; or, mixed Varietie of pleasant Roundelays and delightful Catches of 3, 4, 5, 6, 7, 8, 9, 10 parts in one"—which was the earliest collection of the sort in our country. Later in the same year came "Deuteromelia; the second part of Musick's Melodie," &c., and it is in this latter collection that we find the catch "Hold thy peace, thou knave," immortalized by the use Shakespeare has made of it in his "Twelfth Night." In 1611 he printed his "Melismata, Musical Phantasies," &c., in which is his justly admired four voiced song, "Canst thou love and lie alone?" In 1611 appeared his "Brief Discourse," &c., another collection of twenty part-songs, to which is prefixed a discourse or essay on the old musical proportions. In 1621 he published "The Whole Booke of Psalmes, with the Hymnes Evangelicall and Spirituall," the work by which he is best known. Many of our most famous tunes find their original in Ravenscroft—"The Old Hundredth," "Dumdee," "York," "St. David's," &c. The work contains a melody for each of the hundred and fifty psalms, many newly composed, and all harmonized. Ravenscroft died about 1640.

RAY (Batoidæ) is a large group of fishes forming with the Sharks (Selachoidæ) the order CHONDROPTERYGII (or Plagiostomi). The rays are distinguished by their broad, much depressed body, which, by the expansion of the pectoral fins, has a circular, ovate, or rhomboidal shape, and is usually terminated by a slender tail. In some of the rays, however, which lead an active life, as the Saw-fishes (Pristidæ), the body is elongated, and more resembles that of a shark in shape. There are five gills opening on the under side of the body; they communicate with spiracles, which open on the head behind the eyes. There is no anal fin; and the two small dorsal fins, usually present, are situated on the tail. The pectoral fins are very broad, and in the typical forms extend to the snout, and the ventral fins are placed close behind them. The true rays live a sedentary life, moving about slowly at the bottom of the sea by undulations of the expanded pectoral fins, and feeding chiefly on molluscs and crustaceans. Most of them live at no great depth, near the coast. Some are inhabitants of fresh waters. Most are oviparous, the eggs being deposited in a case like that of some sharks. About 140 species are known. The rays are divided into six families by Günther ("Study of Fishes," Edin., 1880).

The Pristidæ or SAWFISHES are distinguished by their shark-like body, with a strong muscular tail, and by their very long flattened snout or "saw," each edge of which is armed with a series of strong teeth. Five species are known from tropical and subtropical seas.

The Rhinobatidæ resemble the sawfishes in appearance, but lack the saw characteristic of those fishes. About sixteen species are known, chiefly from the tropics.

The Torpedinidæ or Electric Rays are remarkable for possessing electric organs, lying between the head and the pectoral fins, and developed out of muscular tissue. The body in front of the ventral fins forms a broad, ovate, smooth disc.

The Rajidæ contain the true rays, the larger species with a large and pointed snout being known as "skates." The body is broad and of a rhombic form, the pectoral fins extending to the snout. The ventral fins are usually divided into two by a deep notch. The skin is more or less covered with short sharp spines. Of the typical genus *Raja*, about thirty species are known, chiefly from the northern temperate seas. Seven or eight species are found on British coasts, among which are the common SKATE (*Raja batia*), the Homelyn Ray (*Raja maculata*), and the THORNBACK (*Raja clavata*). Most of the skates and rays are eaten, and some of the former attain a large size. Three other genera, each containing a single species, are found in tropical seas.

The Trygonidæ or STING-RAYS are distinguished by the pectoral fins being prolonged so far forward as to unite in front of the snout, and by the tail being usually armed with a strong serrated spine, which is capable of inflicting severe wounds; the dorsal fins are usually absent. A large number of species are known, chiefly from tropical seas, one of which (*Trygon pastinaca*) occurs on the coasts of England and Ireland.

The Myliobatidæ or Eagle Rays attain a very large size, and have the pectoral fins so greatly developed as to resemble wings; there is a pair of cephalic fins at the extremity of the snout, formed of detached portions of the pectorals. The tail is very long and slender, and has generally a serrated spine placed behind the dorsal fin. About twenty species are known from tropical and temperate seas. *Myliobatis aquila* is found almost all over the world, and occasionally appears on British coasts; it is more common in the Mediterranean, and its flesh is eaten in Italy. The Ox-rays or Sea-devils (*Dicrerobatis*), one of which has been occasionally taken on the coast of Ireland, are the giants of the whole group, one having been taken at Messina weighing 1250 lbs. They bring forth their young alive, only one being born at a time.

RAY, JOHN, or WRAY (as he at one time wrote his name), who may be considered as one of the founders of the true principles of classification in the vegetable and animal kingdom, was the son of a blacksmith, and was born at Black-Notley, near Braintree in Essex, 29th November, 1627. He received a good education, having been sent first to the grammar-school at Braintree, and afterwards to the University of Cambridge, where he entered at Catharine Hall, but subsequently removed to Trinity College, of which he was elected a fellow in 1649, together with Isaac Barrow. At the age of twenty-three he was appointed Greek lecturer, and two years afterwards mathematical tutor to his college.

At the Restoration he took orders, but never held any church preferment, nor performed regular parochial duty; and two years afterwards he was obliged to resign his fellowship in consequence of the passing of the Act of Uniformity, to which he could not conscientiously subscribe. After leaving the university he resided chiefly with Mr. Willughby at Middleton Hall, Warwickshire, and devoted the remainder of his life solely to the pursuits of natural history. In 1663 he embarked for a three-years' scientific tour on the Continent with his patron. In 1667 he was elected a fellow of the Royal Society, to whose *Transactions* he contributed some valuable papers. In 1672 Willughby died, and Ray, after superintending the education of Mr. Willughby's children for some time, settled in 1679, after one or two removals, at Black-Notley, his native place, where he remained till his death, in 1705. He was not more respected for his scientific acquirements than for his benevolence, which was combined with high moral and religious worth.

Ray left many works, among which we may name the following:—The "Catalogue of Plants growing in the Neighbourhood of Cambridge," contains a description of

626 species arranged alphabetically, and accompanied with the synonyms of the principal botanical authors who had preceded him. A supplement to this catalogue appeared in 1663, and a second in 1685.

In 1682 appeared his "*Methodus Plantarum Nova*," one vol. 8vo, a new scheme of classifying plants, which unquestionably formed the basis of Jussieu's system, and is therefore in general acceptance at the present day. While making important improvements in classification, he did not neglect the study of species; his "*Catalogus Plantarum Angliæ*" first appeared in 1670, arranged alphabetically, and has been the basis of all subsequent floras of this country. A second edition appeared in 1677, and in 1690 he published a third, entitled "*Synopsis Methodica Stirpium Britannicarum*," which is arranged according to his natural system. In 1694 he published "*Stirpium Europæarum extra Britanniam crescentium Sylloge*." This work contains a description of all those plants which he had himself collected on the Continent, as well as many which had been described by others. The synonyms are here very exact. His largest botanical work was a general "*Historia Plantarum*," the first volume of which came out in 1686, folio; a second appeared in 1688; and a third, which was supplementary, in 1704. In this vast work he collected and arranged all the species of plants which had then been described by botanists, enumerating 18,625 species.

In zoology Ray ranks almost as high as in botany; and his works on this subject are even more important, as they still, in a great measure, preserve their utility.

The "*Ornithologia*" of Willughby, which was the first part of the work that appeared, was published in 1676, one vol. folio, with seventy-seven plates. An English translation of it, by Ray, appeared the following year. The remaining part, which is the most complete, was the "*Historia Piscium*," and did not come out till 1686, two vols. folio. These works contain a great number of new species of birds and fishes, which had been discovered by Willughby and Ray in Germany and Italy, as well as those which had been previously described.

Ray published several works of his own on zoology, of which the most important is his "*Synopsis Methodica Animalium, Quadrupedum, et Serpentinæ Generis*," one vol. 8vo (1693). Similar volumes on birds and fishes were also prepared by him, but were not published till after his death, by Dr. Derham, in 1718.

In addition to his numerous scientific writings, Ray composed several works on divinity and other subjects, the best known of these are—"A Collection of Proverbs," which came out in 1672, and went through several editions; "The Wisdom of God in the Creation" (1690), which also had an extensive sale; "A Persuasion to a Holy Life" (1700); and three "Physico-Theological Discourses concerning Chaos, the Deluge, and the Dissolution of the World" (1692).

RAYMOND, the name of seven counts of Toulouse, of whom we notice three.

RAYMOND IV., called *Raymond of St. Giles*, Count of Toulouse, Duke of Narbonne, and Marquis of Provence, was the youngest son of Pons, count of Toulouse. He succeeded to the throne in 1093, and had for his share on the division of the paternal estates the earldom of St. Giles, which comprised a part of the province of Nîmes. He married his cousin, the daughter and heir of Bertrand, count of Provence. In 1094 he was summoned by Pope Gregory VIII. to the defence of the patrimony of St. Peter, against the attacks of the Normans. The pontiff, however, soon after excommunicated him on the grounds that he had married within the ties of consanguinity. Raymond having reconciled himself with the Pope, married Elvira, the daughter of Alfonso, king of Castile, receiving with her a large sum of money, which served to defray the expenses attending his journey to the Holy Land with the

First Crusade. This prince was among the first who responded to the appeal of Peter the Hermit; and after three years spent in preparation, left for Asia overland with an army of 100,000 men, leaving the government of his estates in his absence to his son Bertrand. After numerous adventures Raymond succeeded in making himself master of Constantinople. Having landed in Asia the crusaders laid siege to Nice, which fell into their hands. Antioch was the next city which they attacked, and upon its surrender a quarrel arose between Raymond and Bohemond, both laying claim to the government. On the 15th of July, 1099, Jerusalem surrendered to the crusaders, who offered the crown to Raymond. Upon his refusal to accept the proffered honour, Godfrey de Bouillon was elected king. After remaining some time in the Holy Land he returned to Constantinople, where he met reinforcements under the command of Hugues, brother of Philip of France. At their request he accepted the command, but fortune no longer favoured him. On the taking of Tortosa he left the crusaders, and with his own followers commenced operations before Tripoli. On the completion of a castle erected by him within 2 miles from the city, which he called Mont Pelerin, he commenced its blockade. He did not live to see his plans carried out; for, worn out with fatigue, he expired in 1105, and was buried in his newly constructed castle. He left issue two sons, Bertrand and Alphonse Jourdain, both of whom succeeded him.

RAYMOND V., Count of Toulouse, Duke of Narbonne, and Marquis of Provence, born in 1134, was the son of Alphonse Jourdain, count of Toulouse, and succeeded to the title on the death of his father in 1148. After a turbulent life Raymond died at Nîmes in 1191, and was succeeded by his son, Raymond VI. This Count of Toulouse has been much celebrated by the troubadours, of whom he was a warm admirer and patron.

RAYMOND VI., called the *Old*, was the son of Raymond V. and Constance of France, and was born in 1156. At the commencement of his career he quarrelled with the church, and in 1196 was excommunicated by Pope Celestine III. In the same year he repudiated his wife, Bourguigne of Cyprus, whom he had married during the lifetime of his father, and espoused Jane, the daughter of Henry II. of England, and sister of Richard Cœur de Lion. On her death in 1199, he married Eleanor of Aragon. About this time the heresy of the Albigens began to attract the notice of the Church of Rome, and Pope Innocent III. repeatedly sent legates into the country if possible to extinguish the heresy. In 1208 the last of these legates, fearing personal violence, prepared to quit the country. On entering a boat to cross the Rhine, he was attacked by two assassins, and died shortly after. It has never been proved that Raymond was privy to the murder, although his diffidence in the parent of the assassins lays him open to some suspicion. Innocent III. proclaimed a crusade against him. In the summer of 1209 a formidable army had assembled on the banks of the Rhine, and Raymond himself, as the price of his pardon for the Holy See, was compelled to serve in it against his own subjects. Twenty-four thousand men lost their lives in the massacre which followed, and the Abbe de Cîteaux cried out when observing the crusaders timid lest they should kill the orthodox with the heretics—"Kill all, God will know who are his." Simon de Montfort was now at the head of the crusaders, and some differences having broken out between him and Raymond, the unfortunate count was excommunicated for the third time, and in 1210 proceeded to Rome to defend himself before Pope Innocent III. Alarmed for the safety of his dominions, he returned to their defence. In 1211 the crusaders invested Toulouse, but were defeated by Raymond. Eventually, however, the city fell in 1213. The cause of Raymond was now hope-

less. In 1215 the council of Lateran having declared his estates forfeited, conferred them on De Montfort; but Raymond found means to raise 100,000 men in 1217, and to attack Toulouse. De Montfort lost his life, some say by the hand of a woman, and once more the cause of Raymond was predominant. In 1219 Louis, the son of Philip Augustus, king of France, attempted to take Toulouse, but failed. Raymond died in 1222, having succeeded in re-establishing himself on the throne of his ancestors. He was married five times, but is only known to have had two children, Raymond, surnamed the Young, and Constance or Clémence, who was married to Sancho, king of Aragon.

RAZOR-BILL (*Alca torda*) is a sea bird belonging to the same family, Alcidae, as the auk, puffin, and guillemot. It is common in the North Atlantic, and breeds in great numbers on some parts of our coasts, especially near Flamborough Head. It is distinguished from the guillemots, which it resembles much in appearance and habits, by the peculiar shape of its bill, which is long, much compressed, and deeply furrowed, as well as by its elongated wedge-shaped tail.

The razor-bill is about 17 inches in length. The head, neck, and upper part of the plumage are black, with a distinct line from the base of the bill to the eye, and a narrow bar across the wings; the under parts are white; the bill is black, with a white streak down the sides of each mandible. In winter the throat and fore parts of the neck are white. It breeds on the ledges of high cliffs, concealing its single egg in holes and crannies; the egg is usually white, with black spots, but the spots are not unfrequently of a reddish tint. The eggs, which are esteemed a delicacy, are taken in great numbers, but the means by which they are obtained is perilous, and requires no little nerve. A large stake or bar of iron is driven into the top of the cliff (500 or 600 feet in height), to this stake is fastened a strong rope, at the end of which a stick is put crosswise, on which rides the adventurer, who is lowered down the front of the precipice. If his object be to secure the eggs only he shouts to scare the birds away, which rise in countless numbers, uttering discordant cries; but if his object be the feathers, which are valuable, he goes to work in silence, and knocks down all the birds within his reach. The flesh is worthless, but is used by fishermen as a bait for crab-pots, &c. This plan is practised in the Isle of Wight, in the Isle of Man, and the Fern Islands, as well as along the indented coast of Norway.

RAZOR-FISH (*Solen*) is a genus of Molluscs, belonging to the class LAMELLIBRANCHIATA, and family Solenidae. The animal has a large and powerful foot, more or less cylindrical; the siphons are short and united; the gills are narrow and prolonged into the branchial siphon. The shell is very long, somewhat cylindrical, straight or slightly curved, and gaping at both ends; the ligament is external, the hinge-teeth compressed, the posterior bifid. The razor-fishes live buried vertically in the sand, at extremely low water, their position being indicated by a small orifice. When the tide goes out they sink deeper, and have been found at a depth of about 2 feet. If taken from the sand they speedily bury it again. The species are rather numerous, and only wanting in Arctic seas. The common British species (*Solen vagina*) is esteemed for food; it is commonly caught by salt being put into its burrow, which reaches the siphons, and so irritates the animal that it rises out of the sand.

RAZ'ZIA, an Arabic word, at one time much employed, in connection with Algerine affairs, to signify an incursion made by military into an enemy's country for the purpose of carrying off cattle and destroying the standing crops.

RÉ, ÎLE DE, anciently *Rodi*, later *Rex Insula*, an island on the west coast of France, 5 miles west of Rochelle,

whose harbour is protected seaward by this island and Oléron. It is 20 miles long by 1 to 4 broad; with bold coasts south and west, and numerous salines on the inner side, from which a great quantity of salt is made. The vine is largely cultivated, and there is a valuable fishery. A great oyster park in the vicinity of the island yields about 300,000,000 oysters annually.

READE, CHARLES, a distinguished English novelist, was the son of Mr. John Reade, a popular Oxfordshire squire, and was born at Ipsden in 1814. He was educated by private tutors, and at Magdalen College, Oxford, proceeded B.A. in 1835, was elected Vinerian reader in 1842, and was called to the bar in 1843. His ambition, however, was to shine as a dramatist and author, and in 1850 he made his first appearance before the public with the play entitled "Gold," which was only moderately successful. In 1852 he published the novel, "Peg Woffington," an excellent piece of historical realism, and in 1853 "Christie Johnstone," a close, tender, and thoughtful study of the Scottish fisher-folk. In 1856 he achieved popularity, and scored his first great success with the powerful study of prison life, entitled "It's Never too Late to Mend." This was the first of a series of novels, written with the serious purpose of reforming social abuses, and its publication gave him a place in the front rank of English novelists. During the next few years he issued in quick succession "The Course of True Love" (1857); "Jack of all Trades," and the "Autobiography of a Thief" (1858); "Love me Little, Love me Long" (1859); and "The Double Marriage, or White Lies" (1860). The following year there appeared "The Cloister and the Hearth," a careful and powerful study of life in the fifteenth century, which many critics consider the finest of his works. In 1863 he published "Hard Cash," a story directed against the abuses of private lunatic asylums; "Griffith Gaunt," a novel which he always considered his masterpiece, in 1866; "Foul Play," a story designed to expose the seamy side of shipwrecking in 1869; and "Put Yourself in his Place," an exposure of the outrages and murders of the trades' unionists in 1870. In 1871 he issued "A Terrible Temptation," in which he introduces a portrait of himself under the name of "Dr. Rolfe;" in 1873 appeared "A Simpleton," and he subsequently published "The Wandering Heir" (1875); "A Hero and Martyr" (1876); "A Woman Hater" (1877); and he afterwards completed a novel entitled "A Perilous Secret," which was not published until after his death. In addition to the production of these works of fiction he wrote in conjunction with Tom Taylor a stage version of "Peg Woffington," under the title of "Masks and Faces;" "The Courier of Lyons," a powerful melo-drama; "Two Loves and a Life," and "The King's Rivals" (1854). Two versions of "Foul Play," one written in conjunction with Mr. Dion Boucicault, and one alone, were failures, but his adaptation of Zola's "L'Assommoir," entitled "Drink," produced in 1879, was very successful. He died 11th April, 1884.

Although he cannot be ranked with the greatest masters of fiction, Reade possessed a keen sense of dramatic fitness, a powerful imagination, and great skill in maintaining the interest of his readers, while he displayed a perfectly marvellous industry in the accumulation of materials for his work. Of a pugnacious disposition, he excelled in controversy, and his terse epigrammatic style never showed to greater advantage than in his trenchant exposure of abuses or his vigorous replies to his critics.

READING, a town of England, the county town of Berkshire, and a municipal and parliamentary borough, is situated on the river Kennet, just above its junction with the Thames, 36 miles from the Paddington station, London, by the Great Western Railway, or 42 miles from the General Post Office by Brentford, Hounslow, and Maidenhead.

The town lies partly between the Kennet and the Thames,

and partly on the south side of the Kennet. It is somewhat irregularly laid out; but it is well paved, and in 1878 a thorough system of drainage and water supply was completed. The houses are in general substantial and built of brick; but there are some old ones of lath and plaster, with high gables, which, however, are fast disappearing. There is a fine tower at the west end of St. Lawrence's Church. The whole building was carefully restored in 1867. St. Mary's Church was rebuilt about 1551, chiefly from the materials of the abbey church, then pulled down. It was considerably enlarged and beautified in 1861. St. Giles' is the other parish church. The church of the Gray Friars, long used as a bridewell, is not surpassed in architectural beauty by any in the county. St. John the Evangelist is a church in the French-Gothic style, erected in 1873. There are commodious places of worship for most denominations of dissenters. A town-hall, comprising also library, reading-rooms, museum, and schools for science and art, was opened in 1882. Municipal buildings (with a tower 100 feet high) were erected in 1876. The county gaol is a handsome building, but so much cannot be said for the assize courts. The corn exchange is a handsome and commodious structure. There is a large union workhouse, and the town also contains a public library, a subscription news-room, a small theatre, and public baths. The grammar-school, originally founded in the reign of Henry VII., and endowed with property belonging to the decayed hospital of St. John, received great additions from Archbishop Laud, who was the son of a clothier in the town, and Sir Thomas White. In 1871 a new building was erected for it close to the town, at a cost of £25,000. There are also a Blue-coat School for boys, and a Green-coat School for girls. Reading also has a county hospital and numerous almshouses and money charities, few towns of a similar size in England having so large an amount of property held in trust for charitable purposes. There are also a dispensary and eye infirmary. As the river Kennet has a divided channel, there are many bridges; that over the main stream, in Duke Street, is a handsome stone structure of one arch with balustrades. The abbey was founded by the Benedictines in 1121, and was at one time the third in wealth and size in the kingdom. Nothing but the walls now remain. These, however, are well worthy of attentive examination. From their massiveness they have more the appearance of detached rocks than of the works of human hands; and the large spaces which some of them inclose must suggest the immense size of the fabric of which they were portions. Part of the former site of the abbey, now laid out as ornamental gardens, and including a remarkable circular mound called the Furbury, forms a very agreeable promenade, to which the public have free access. A recreation ground, 26 acres in extent, was presented to the town by Alderman Palmer in 1876.

The trade is considerable, and a very large business is done at the weekly markets. There was anciently a large manufacture of woollen cloth, but it has become extinct. There are several large breweries, extensive ironworks, and the largest private biscuit factory (Huntley and Palmer's) in the kingdom. Sutton's seed nurseries are very extensive, and the works for the manufacture of the tin boxes for biscuits and for Bryant and May's matches employ a large number of hands. Trade is carried on in corn, seeds, malt, timber, bark, hoops, wool, cheese, and beer. The Kennet is navigable to the Thames; the Kennet and Avon Canal affords a water communication with the west of England; and there are no less than three lines of railway to London—the Great Western, the South-western, and the South-eastern. The town is altogether in a very prosperous condition.

The municipal borough is divided into three wards, and is governed by a mayor, five aldermen, and eighteen councillors. The parliamentary and municipal boundaries are

the same. The population at the census of 1881 was 42,050. Since 1885 the town has only returned one member to the House of Commons. The assizes for Berkshire are held at Reading.

The name of the town is derived by some authorities from the British word *readin*, fern, which grew here and in the neighbourhood luxuriantly; but more probably, from its Saxon settlers, the descendants of Ræda, the Redingas. By others it is supposed that it was named by the ancient Britons as from *rhÿd*, a ford, and *ing*, a meadow. The town was fortified as early as 871, in which year it was taken by the Danes, who held it until 1006, and then destroyed it by fire. In Domesday Book "Redinge" is stated to have had twenty-eight houses, so that it appears then scarcely to have recovered from the calamity of 1006. The abbey was used as a royal residence by Henry I. and several of his successors, and Parliaments were held here in 1440 and 1451. In the Parliamentary war Reading was held for the king. Essex besieged the town for a fortnight, and upon King Charles and Prince Rupert coming to its relief, a battle ensued on Caversham Bridge, when the Royalists were defeated. The abbey suffered greatly during the siege.

READING, a town of the United States, in Pennsylvania, 58 miles north-west from Philadelphia, is situated on the east bank of the Schuylkill (which is crossed here by two covered bridges), at the junction of two canals and of several railways. The population in 1880 was 43,278. The principal buildings are a handsome court-house, numerous churches, gaol, public offices, &c. Anthracite coal, iron ore, and limestone are obtained in the neighbourhood. There are very extensive ironworks, and the works of the Philadelphia and Reading Railway are in the town. Tanning, paper-making, and cotton weaving are also carried on.

RE'AL (the Spanish for royal, just as we call our unit of value a sovereign), the old unit of value in the coinage of Spain, now superseded. Ten reals made the *escudo* or crown piece. Like the English penny, the real had many different values at different times, from 2½d. to 5d. sterling; but, unlike the English penny, all these values circulated at the same time, and the coinage, besides being thus mixed, was in a very worn condition. In June, 1864, a law was passed, making the standard silver real 1.298 gramme, .810 fine, and worth, therefore, twenty-three French centimes, or about 2½d. But this had not much effect, and Spain therefore entered the Latin Monetary Union and adopted the franc as an unit, with the Spanish name of *pereta*. Reals, however, still circulate, as the government is too poor to call them in.

The *real of Mexico* is the eighth of a dollar, and is worth about 6½d.; the *real of the Philippines* is, however, but the twentieth of a dollar, and worth only about 2½d.; while the *real of Columbia* is the eighth of the *sencilla*, and worth 5d. The *real of Uruguay* is a silver coin worth 1½d.; but there is another real in that country, the *real corriente*, or currency real, not a coin, but a money of account, existing only in the form of a "five-real piece corriente" in silver, weighing 13.01 grammes, .883.8 fine, and worth 22.927 pence, or closely on 1s. 11d.

REAL ANSWER, REAL FUGUE. See FUGUE.

REAL PRESENCE. For many centuries, certainly down to the Lateran Council of 1215, the precise manner in which the body and blood of Jesus Christ are really present in the Eucharist was not defined. Even as late as St. Bernard we get such phrases as "Keep fast the faith without wavering, and inquire not into the manner." But the doctrine of transubstantiation, affirmed at the council of 1215, had gradually grown stronger, and was at length formally confirmed, adopted, and enforced by the Council of Trent as the teaching of the Roman Catholic Church, on 11th October, 1551. This doctrine is that upon consecra-

tion the whole substance of the bread and wine used in the Eucharist become changed into the whole substance of the body and blood of Christ, so that no part of the former remains except the appearance and attributes perceptible by the senses, and no part of the latter is lacking.

Opposed to transubstantiation is the doctrine of *consubstantiation* taught by Luther and his party among the reformers. Luther held that the substance of the sacred elements remained, as well as their outward attributes, but that with and under these are the true body and blood of the Saviour. Others of the reformers, led by Calvin, went far beyond this, and asserted that there was no real but only a symbolical presence of Jesus's body and blood in the Eucharist, and this denial is largely shared in by Christians to-day.

The doctrine of the Church of England claims to be a reversion to the Catholic doctrine before the council of 1215, that is, it affirms the real presence, but refuses to define the mystery further than to repudiate transubstantiation. The High Church party usually approach closely to consubstantiation in their teaching; the Low Church party to symbolical, not real presence. The general teaching is this: "It is bread, and it is Christ's body. It is bread in substance, Christ is the sacrament; and Christ is as really given to all that are truly disposed as the symbols are, each as they can; Christ as Christ can be given; the bread and wine as they can; and to the same real purposes to which they are designed; and Christ does as really nourish and sanctify the soul as the elements do the body" (Jeremy Taylor).

REALGAR or **RED ORPIMENT**, a brilliant scarlet pigment, a soft native sulphuret of arsenic (about 75 parts of arsenic to 25 of sulphur), found in prismatic or needle-shaped crystals. The word is the Arabian *rah-jal ghar*, powder of the mine.

Realgar (the composition of which is As_2S_3) is made artificially by distilling a mixture of arsenical ores (ores

Fig. 1.

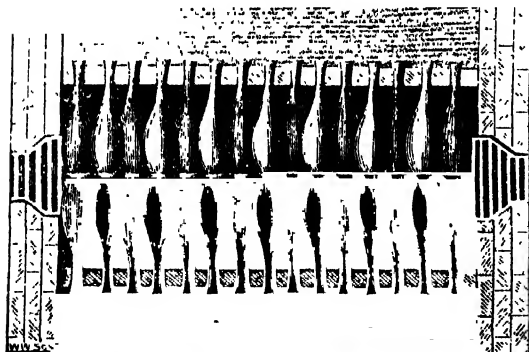
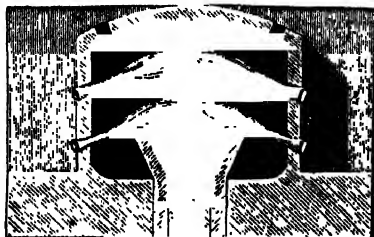


Fig. 2.



containing arsenical and iron pyrites) with sulphur, or the sulphide of arsenic precipitated in purifying sulphuric acid. The materials should be mixed so as to contain 15

per cent. of arsenic and 26 to 28 per cent. of sulphur, since much of the sulphur will be driven off in the process. A furnace and gallery are erected, in which a number of earthen retorts are placed, as seen in the annexed cuts, figs. 1 and 2.

The retorts (which are of earthenware) are charged every twelve hours with 60 lbs. of ore to each; they are connected with similar vessels for receivers, which are permeated by a number of small holes to allow the gases to pass off. They are then gradually heated to redness, and kept in that state for eight, ten, or twelve hours, when the furnace is allowed to cool; the receivers are taken off, and the crude realgar taken from them for remelting. The crude product is almost sure to have either too much arsenic or too much sulphur.

REALISTS. See NOMINALISTS.

REAL SCHULEN, the "modern side" in German public school life, as opposed to the "classical side" or *gymnasiums*. In England these sides divide our great schools, in Germany they form separate schools. The real-schools, i.e. schools of real or positive instruction, aim at teaching facts rather than at training the mind, as in the gymnasiums, and they assert that the latter will come about through the former, as well as by the usual classical course. Therefore more time is given to physical science, modern languages, drawing, &c. The division of studies is often after this model—Latin 5 hours per week; Mathematics 5, French 5, German 5, English 3, geography and history 3, sciences 3, religion 3, drawing 2, writing 2. In 1870 the minister of public instruction for Prussia admitted pupils of the real schools without further examination into the universities (a privilege then only granted to the gymnasiums). This order still holds good, though often attacked from the side of the universities themselves.

REAPING MACHINES. See AGRICULTURAL IMPLEMENTS.

REASON, according to the common notion, is the highest faculty of the human mind, which enables a man to contemplate things spiritual as well as material, to weigh all that can be said or thought for and against them, and hence to draw conclusions, and to act accordingly.

Thus far reason is of a purely practical nature, and Kant therefore divided reason (if we may venture to translate his word *Vernunft* by the English word *reason*) into practical and theoretical. The latter, which is also called pure, ideal, or transcendental reason, is, according to him, the mind's power of producing ideas *a priori* from its own resources, or the power of conceiving things and their attributes which lie beyond the sphere of our experience, such as infinity, the absolute, God. How far our knowledge of these things can extend is shown in the work of Kant, entitled "*Kritik der reinen Vernunft*," or "Criticism of the Pure Reason." Reason, in its practical acceptance, forms ideas *a posteriori*, in as far as it derives them from a consideration and comparison of the phenomena of the external world, endeavours to discover unity in variety, and traces all phenomena to one source, a supreme reason, of which human reason is only a reflex.

Schelling defines reason to be the identity of the subjective and the objective, that is, the identity of the power which knows and that which it knows, which includes the knowledge of this identity. As the original identity, says he, exists in God, or is God, reason is a direct knowledge or an intellectual perception of God, of whom no indirect knowledge is possible. Hence God and reason are essentially of the same nature; they are identical: God is in reason, and reason is in God.

REASONING. See RATIOCINATION.

REAU-MUR, RENE-ANTOINE FERCHAULT DE, a distinguished French zoologist and physicist, was born at La Rochelle 28th February, 1683. Possessing an independent fortune he gave up the law, for which he had

been educated, and went to Paris in 1703, where he determined to devote his life to scientific pursuits. In 1708 he read some geometrical observations before the Academy of Sciences, which were so well received that he was admitted a member at the age of twenty-four. He belonged to that body for fifty years, and contributed a number of papers to their *Memoirs*.

The chief objects of his attention were the improvement of the arts and manufactures of his country, and natural history. The most important of Réaumur's labours in the department of the arts were the experiments which he made on the manufacture of iron and steel. He published his researches on this subject in a separate work, entitled "*Traité sur l'Art de convertir le Fer en Acier, et d'adonner le Fer Fondu*." He here describes the process of making steel, which was then unknown in France, and he also discovered the art of tinning iron, which was likewise unknown in France. Among his other labours he greatly improved the manufacture of porcelain. In 1711 he discovered a species of mollusc from which a purple dye might be prepared analogous to the purple of the ancients.

In general physics the name of Réaumur is celebrated from the thermometer which he invented in 1731. The centigrade thermometer, now in more general use in France, was only an improvement on Réaumur's, the interval between the freezing and boiling points being divided into 100 instead of 80 degrees.

Of all the works of Réaumur, the most remarkable are his "*Mémoires pour servir à l'Histoire des Insectes*," of which six volumes appeared between 1734 and 1742. Réaumur passed a quiet retired life, and his private history is unmarked by any important incident. His death took place 17th October, 1757.

RE'BAB, an Arab instrument of the violin class, usually with two strings, otherwise very similar to the Old English rebeck, which had three strings. The Persian rebabs have also usually three strings. See **REBECK**.

RE'BECK or **RE'BEC**, sometimes called *Rebebe* and *Reberbe*, the bowed instrument of the violin class, with three strings, found in most European countries in the middle ages. It was of a pear-shaped outline, and bore three strings, tunable by pegs in a hollow head of the fiddle character. The rebeck, however, was not hollow like the violin, but solid. Nearly at the broadened part it was cut down at one step to about half its thickness and roughly scooped out; over the chamber thus made was fixed a pine belly, supported by a sound-post, pierced with two holes and bearing a bridge, the upper part (solid) of the instrument serving as neck and finger-board. The rebeck either rested against the shoulder or the breast. Its harsh shrill sound was heard in the streets long after the violin had driven it from higher musical service; it was heard in France in the eighteenth century. It was the favourite accompaniment of rustic dances when the pipe and tabor were found insufficient in refinement.

"When the merry bells ring round
And the jocund rebecks sound
To many a youth and many a maid
Dancing in the chequered shade,"
—Milton's "*L'Allegro*."

RE'BITE or **RIB'IBLE**, a small variety of **REBECK**.

RE'BUS, an enigmatical representation of a name or thing by using pictorial devices for letters, syllables, or parts of words. The term probably arose from the device speaking to the beholder *non verbis sed rebus*. For instance, on the rector's lodgings at Lincoln College, Oxford, to which Bishop Beckington liberally contributed, is carved the rebus of that prelate: a *beacon* and a *tun*, with T, the initial letter of his Christian name. This is termed a pictorial rebus, but there are other and more common varieties, of which we give an example:—Biographical Rebus: 1, a famous political economist; 2, a Saracen con-

queror of Egypt; 3, a French advocate and statesman; 4, a former governor-general of India; 5, a famous empress of Constantinople; 6, a distinguished German ecclesiastical historian.

The initials and finals of the above, read downwards, will give the name of a celebrated religious reformer.

Mill
AmroU
RegnaulT

TeignmoutII
IrenE
NeanderR

RECEIPT, a written discharge of a debtor on the payment of money due. If the sum paid exceeds 40s. the receipt must be stamped with a penny stamp, otherwise it is inadmissible as evidence of payment. Adhesive stamps (which can be used either as postage or receipt stamps) are sold for this purpose, as well as stamped paper. Receipts given on payment of bills of exchange or promissory notes, and any note or memorandum given to a person on payment of money, are liable to stamp duty. A receipt, though evidence of payment, is not absolute proof; for this evidence may be rebutted by showing that it has been given under mistake or obtained by fraud. The only object of requiring a stamped receipt is to obtain revenue. It is one of the many modes of taxation.

RECEIVER. A receiver is a person appointed by a court to receive the rents and profits of land, or the produce of other property, which is in dispute in a cause in that court. He is an officer or agent of the court, and as such under its general control.

The cases in which a receiver is appointed are those in which there is great danger of property being wasted or lost, owing to the want of a proper person to look after it. The following are some instances in which a receiver will be appointed:—When an infant is entitled to real estate, especially if it be of considerable magnitude; in suits between partners in trade for the purpose of winding up the concern, when a partner is grossly misconducting himself; and when there is danger of the assets of a testator being lost or wasted through the misconduct of an executor. A receiver must, as a rule, find sufficient sureties. He is paid by a percentage on the sums which he receives; and sometimes, in the case of large estates, by a salary. The court may, however, refuse to allow payment, and sometimes one of the parties to the cause, with the consent of the others, acts as receiver without pay. A receiver must annually pass his accounts before the chief clerk of the court by which he is appointed. In Scotland the equivalent for the office of receiver is a judicial factor, appointed by the Court of Session under its equitable powers, whose duties are regulated by 12 & 13 Vict. c. 59.

RECEP'TACLE, in botany, is the term used to express that portion of the floral axis which bears the parts of a flower or several flowers close together. Examples of receptacles of the latter kind may be seen in the heads or *capitula* of the daisy, thistle, and other *COMPOSITÆ*, also in the fig, which contains the flowers inside.

RECH'ABITES, the name of a religious order in ancient Israel, the members of which resembled the Nazarites in their abstinence from wine, but who went further in asceticism than the latter, inasmuch as they dwelt only in tents and planted nothing. There is much obscurity over their origin, but they appear to have been a branch of the Kenites, and to have derived their peculiar characteristics from that Jehonadab or Jonadab, son of Rechab, mentioned in connection with Jehu (2 Kings x.) After the destruction of the northern kingdom some members of this family or order seem to have found refuge in Jerusalem, and we find them blessed for their fidelity by the prophet Jeremiah, and held up as an example to Israel (Jer. xxxv. 12-19). According to Jewish tradition the blessing of the prophet was realized by the Rechabites intermarrying with the Levites. They are mentioned as a

distinct family or order among the priests of the temple at Jerusalem by Hegesippus in his account of the martyrdom of James the Just.

RECIPE ("Take now" so and so), the first word of a physician's prescription, indicated by the letter R. The letter as used by physicians has a cross stroke, thus \mathcal{R} ; and the cross stroke is the remains of the astronomical sign for Jupiter, Υ , and is derived from the practice of the ancient Latin physicians to invoke Jupiter to aid the operation of their drugs.

The word naturally came to be used for the prescription of any mixture written in the curt form of medical usage, and hence for manufacturing formulas and for those of domestic preparations. In fact the word (often spelt *receipt* quite wrongly) is now most usually employed in that sense.

Nothing is more remarkable than the simplicity and wholesomeness of the recipes of the kitchen in our day as compared with the heterogeneous compounds often indulged in by our forefathers. The following is, however, a fairly reasonable mixture, and may serve as a favourable specimen of ancient kitchen lore; it is the recipe for a Lenten first soup, taken from a rare book, printed from the collection of MS. recipes of the master cook of King Richard II., and dated in its MS. form 1381:—

"Take the blode of pykes oth' [or] of cong' [conger eel] and myne the pauceh of pykes, of cong' and of grete coke lyng, and bolle le [boil hem, i.e. them] tendre and mynce le smale and do be in that blode. Take crust' of white brede and styne [strain] it thurgh a cloth, thenne take onyons iboiled and mynced, take jesp. [pepper] and siftoñ wyne, vynegr' [vinegar] oth' aleg' [alegar, i.e. beer-vinegar] and do thereto and sie [serve] forth."

RECIPROCAL, a mathematical term, chiefly applied to the inversion of a vulgar fraction. Thus $\frac{2}{3}$, $\frac{a}{b}$, are the reciprocals of $\frac{3}{2}$, $\frac{b}{a}$, and *vice versa*; and in like manner $\frac{1}{4}$, $\frac{1}{a}$, are the reciprocals of 4, a , which are equal to $\frac{2}{1}$ and $\frac{a}{1}$ respectively.

RECITATIVE, language delivered in musical tones, that is, in the sounds of the musical scale. It differs from *air* or *melody* in having no fixed time or measure, the length of the notes depending on the singer, who regulates them according to his own notion of the emphasis and expression required. Recitative is used in operas for the purpose of narrative, or to express some action or passion. It was first introduced at Rome by Emilio del Cavaliere or Jacopo Peri in 1600.

RECKONING AT SEA is the process of computing the several elements which relate to the determination of the ship's place at any time. The term may include the operations which are performed in finding the latitude and longitude of the ship, the variation of the needle, &c., from celestial observations; and the part which is independent of these is called the *dead-reckoning*. It is this last only which we propose here to explain.

The reckoning may be said to commence when the ship is on the point of quitting a harbour or road; and the first circumstances to be recorded are the observed bearing and the estimated distance of some remarkable object (*point of departure*) on the coast whose geographical position is known, together with the *ship's course* (the angle which the line of her path makes with the meridian) and her *velocity*, the last being determined by the Log. But at the time a ship is sailing with the wind in a direction oblique to the line of her keel, she is compelled, by the force of the wind and the resistance of the water against her side, to move in the direction of a line which makes

some angle with her keel on the side opposite to that from which the wind is blowing; this angle is called the *leeway*, and as it differs for different ships, it must always be determined by trial in some one of the ways proposed in treatises on navigation.

Again, when a ship is sailing either in a current of the ocean, or in a tide near a shore, her velocity and the direction of her motion will be affected by those of the current or tide. The ship is also made to deviate from the course on which she appears by the compass to have sailed, in consequence of a swell of the sea, by which she may be driven in some other direction. This direction must be observed, and the velocity estimated according to the judgment of the seaman.

Now, let it be supposed that from the noon of one day to that of the next, according to the practice of seamen, memoranda have been made in a journal, at intervals of two hours or otherwise, of the ship's course, her velocity in *knots*, the direction of the wind, the angular leeway, with the estimated directions and velocities of the tide or a current, and of the swell of the sea. Then, in order to determine the ship's place at the noon of any day, the following process is used:—

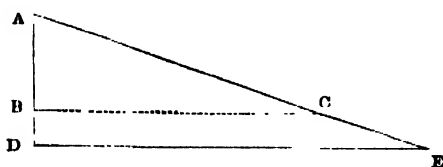
The mean of the number of knots per hour multiplied by the number of hours during which the ship was sailing on one course gives the distance run in that time; and the declination (variation) of the needle being applied to the observed course and to the leeway gives the correct course during that same time. The angular directions of the current, and the swell of the sea, being also corrected for the variation, and the velocities being multiplied by the number of hours, give the correct courses and distances depending on those circumstances. These corrections being made, if the ship is sailing within about 10 degrees on each side of the equator, each of these distances may be considered as the hypotenuse of a right-angled triangle; and, by a graphical construction, by the rules of plane trigonometry, or by the tables of *difference of latitude and departure*, there may be obtained, in each triangle, the distance gained by the ship northward or southward, and eastward or westward: the sum (in the algebraic sense) of the distances in the former direction gives the whole distance gained by the ship during the day northward or southward; and the sum of the distances in the latter direction gives the distance gained during the day eastward or westward. The above process is called *Plane Sailing*.

Should a ship sail for a short time in a direction due east or due west, so that it may be considered without sensible error as sailing on the circumference of a parallel of latitude, its place is determined on dividing the number of miles given by the log by the cosine of the latitude. The result is the amount of longitude gained in the time. This is called *Parallel Sailing*.

The process called *Middle-latitude Sailing* is as follows:—Multiply the sum of all the distances made by the ship, while sailing on one course, by the cosine of the course for the amount of latitude gained: in order to find the amount of longitude gained, multiply the sum of the distances by the sine of the course, and divide the product by the cosine of a latitude which is an arithmetical mean between the latitude of the ship at the commencement and at the end of the course.

In order to determine, by what is called *Mercator's Sailing*, the ship's place when a course and distance are given, a method in accordance with the following construction is used:—Let $A D$ be the direction of the meridian passing through the ship at A , and $A C$ be her course; then, if $A C$ be made equal to the distance in miles by a scale of equal parts, and $B C$ be drawn perpendicular to $A D$, $A B$ and $B C$ measured on the same scale will be the difference of latitude and departure, as in plane sailing. Now, if $A D$ be made, by the same scale, equal to the dif-

ference between the meridional parts which, in the *table of meridional parts* given in any treatise on navigation, correspond to the latitudes of the points A and c, and D E be



drawn parallel to B C, D E on the same scale will express, in miles or minutes, the true difference between the longitudes of A and c.

The inaccuracies in the estimates of the distances run, the effects produced by currents, &c., must, in time, render the results of the reckoning very erroneous; and therefore it is of the utmost importance to correct them frequently by celestial observations. The determination of the latitude by meridional or other altitudes is easy; and that of the longitude by lunar distances or by chronometers should be made as often as possible. Every geographical position thus determined with precision serves, by comparison with the results of the dead-reckoning, to lead to a knowledge of the causes of the errors which exist in the latter, and becomes a point of departure for the next succeeding portion of the voyage.

RECOGNISANCE is an obligation or record entered into before some court of record, or magistrate duly authorized, by which the party entering into it (the cognizor), whose signature is not necessary, acknowledges (recognizes) that he owes a sum of money to the king, or to some private individual, who is called the cognizee. This sum is named the amount of the recognisance. The acknowledgment is generally followed by an undertaking on the part of the cognizor to do some act, such as to keep the peace, to pay a sum of money, to attend to give evidence, and the like. On the performance of this act the cognizor is discharged from his recognisance. On his default, the recognisance is forfeited, and he becomes indebted absolutely to the amount of the recognisance. Recognisance is a term unknown in the law of Scotland. Its equivalent is Bail Bond, or Bond of Caution.

RECOLLECTION. See MEMORY.

RECONNAISSANCE is an examination of a tract of country or of the sea-coast; the latter previously to a disembarkation of troops, and the former preparatory to the march of an army in order either to meet that of the enemy or to take up quarters for the season.

The *military reconnaissance* of a country is a duty appertaining to the officers on the staff of the quartermaster-general; and if the enemy is in the neighbourhood, it is performed under the protection of an armed force. It is considered as one of the most essential operations connected with the tactics of the field, and serves as the basis of every movement or combination which it may be proposed to make.

RECORD, a memorial in rolls of parchment of the proceedings and acts of a court of law, upon whose proceedings error will lie. The higher courts of England file the records of a suit, hence they are called courts of record. If a record is lost, the court may order a new entry to be made at any time. In order to prove a record the existence of which has not been denied on the pleadings, an examined copy is sufficient. But if the existence is denied on the pleadings, it can only be proved by the court inspecting the record; and that is conclusive not only as to the existence of the record, but as to all matters stated in it, for the record of a court of competent jurisdiction is a legal proof of all those proceedings having taken place which the record sets forth; and no averment to the con-

trary in pleading can be made. A record found in the proper office is legally assumed to have been always in the same plight in which it is found. The effect of a reversal of a judgment in error is to annul the previous record from the commencement. It seems doubtful whether in all cases a record must be on parchment. In Scotland the word *record* is not used in this sense; *register* is the equivalent term.

RECORD'ER (Lat. *Recordator*), a judge described by Cowel as "he whom the mayor or other magistrate of any city or town corporate having jurisdiction, or a court of record, within their precincts by the king's grant, doth associate unto him for his better direction in matters of justice and proceedings according to law." The Norman term *recordeur* appears to have been originally applied to every person who was present at a judicial proceeding, and to whose remembrance or record of what had taken place the law gave credit in respect of his personal or official weight and dignity.

The Recorder of London is a judge who has criminal and civil jurisdiction. He is also the adviser and the advocate of the corporation. In respect of the duties performed by the recorder in the assemblies of the corporation, in the courts of mayor and aldermen, of common council, and of common hall, his office may be said to be ministerial. He is by charter a justice of the peace within the city of London, a justice of oyer and terminer, and a justice of the peace in the borough of Southwark.

In cities and boroughs within the Municipal Corporations Act, the recorder (who must be a barrister of not less than five years' standing) is a judge appointed under the sign manual by the crown during good behaviour; he has criminal and civil jurisdiction within the city or borough, with precedence next to the mayor.

The practice or mode of proceeding, and also the course of pleading, in courts of civil jurisdiction in cities and boroughs, are governed by rules made by the recorder, and allowed by the judges of the superior courts.

RECORD'ER, an old English instrument of the flageolet or *flûte-à-bec* family, noticeable chiefly because of Shakspeare's memorable use of it in one of the finest passages in "Hamlet" (act iii. scene 2). The only difference between the recorder and the pipe (or flageolet) was that the former had at one side, near the mouthpiece, a hole covered with a thin bladder, a contrivance which greatly modified the quality of sound. It is very rarely found. The best specimen (shown at South Kensington) is 26 inches in length, and the characteristic hole is an inch from the mouthpiece. It seems to have been softer in tone than the usual pipe, as Milton speaks of "flutes and soft recorders" in "Paradise Lost" (l. 550). Henry VIII.'s music-room inventory contains many recorders catalogued, as of box, of oak, of ivory, great and small, as well as "two base recorders of walnut, and one great base recorder."

The word is synonymous with "warbler," as Shakspeare shows us ("Pericles," act iv.)—

"She sang, and made the night-bird mute,
That still records with moan."

RECORDS, PUBLIC. The records of a kingdom are the great foundation of its history and laws, the indisputable evidence of public and private rights, and the means of determining all great constitutional and international questions. The great value and importance of public records will be seen by considering that they comprise the various acts of the legislature; the decisions and judgments of the several courts of law and revenue; negotiations and treaties with foreign nations; papal bulls and royal letters; proclamations of the crown; grants of sovereigns; all documents relating to coinage, trade, and manufactures, to the state of the army, militia, or navy, and to the countries under the dominion of the British

crown. If we add to these the invaluable collections of charters and other manuscripts contained in the public libraries, the archives of Britain must be allowed to form the most universal repository of every species of legal, historical, constitutional, and antiquarian information. On the continent of Europe the various imperial, royal, and national collections of records are, in almost all respects, inferior to those of Britain. This inferiority on the part of continental collections of records arises principally from the practice of the sovereigns in ancient times carrying their archives with their courts, the consequence of which was that they were frequently lost or destroyed.

In the legal sense of the term, records are contemporaneous statements of the proceedings in those courts of law which are courts of record, written upon rolls of parchment (Britton. c. 27). Matters enrolled among the proceedings of a court, but not connected with those proceedings, as deeds enrolled, &c., are not records, although they are sometimes in a loose sense said to be "things recorded." In a popular sense the term is applied to all public documents preserved in a recognized repository; and as such documents cannot be conveniently removed, or may be wanted in several places at the same time, the courts of law receive in evidence examined copies of the contents of public documents so preserved as well as of real records. Records may then be considered as documents which are received in the courts of justice.

The greater part of records are kept as rolls written on skins of parchment and vellum, averaging from 9 to 14 inches wide, and about 3 feet in length. Two modes of fastening the skins or membranes were employed—that of attaching all the tops of the membranes together bookwise, as is employed in the exchequer and courts of common law, while that of sewing each membrane consecutively was adopted in the chancery and wardrobe.

The material on which the record is written is generally parchment, which, until the reign of Elizabeth, is extremely clear and well prepared. From that period until the present the parchment gradually deteriorates, and the worst specimens are furnished in the reigns of George IV. and William IV. The earliest record written on paper is supposed to be of the time of Edward II.

ENGLAND.—The Public Records of England have been described by Sir Francis Palgrave as excelling, in relation to antiquity, continuity, variety, extent, and amplitude of facts and details, all similar collections in the civilized world. Their excellence in these respects may be chiefly ascribed to the fact that from the earliest periods they have been preserved in fixed repositories, and have been handed down in unbroken series through nearly seven centuries. Authentic and valuable instruments from the time of the Conquest, and parliamentary records and proceedings from a period but little subsequent to it, are still in existence. The amount of care bestowed on the public records during the present century is shown by the appointment of successive commissions and parliamentary committees of inquiry at a cost in one shape or another amounting to little less than a million of pounds sterling, and by the passing of an Act of Parliament designed to effect a complete change in the system of keeping and using them.

Notwithstanding the laborious industry of many distinguished persons in British history, in making researches into the public archives, such as Camden, Spelman, Cotton, Selden, and Blackstone, no effectual measures were taken for the proper care of the public records till the reign of Queen Anne (1704–13). At that time the design was formed of publishing that splendid collection of records known as Rymer's *Fœdera*. Inquiries with a view to further arrangements of them were prosecuted without intermission through the reigns of Anne and George I. to the commencement of the reign of George II.

In 1732 a table of the records of the kingdom was com-

piled by some of the principal record officers, digested in a series, and distinguishing the repositories in which they were contained. The fullest examination into the state of the public records which has been made in recent times was effected by a committee of the House of Commons in 1800, conducted by Lord Colchester, then Mr. Abbot. The result of the inquiry which this committee presented to the House of Commons was two connected reports containing full details of all the recorded memorials of the history, laws, and government of England from the period of the Norman Conquest to the Union between Great Britain and Ireland. In consequence of these reports, commissioners were appointed from time to time to see that the records should be methodized and some of the more ancient and valuable printed. In 1836, as a result of the inquiries of a select committee, the Public Records Act, 1 & 2 Vict. c. 91, was passed, which placed the records in the custody of the Master of the Rolls, and eventually led to the establishment of the present Record Office.

The publications issued by these commissioners, and under the direction of the Master of the Rolls, are of the greatest importance, the principal of which are described in the following list, which shows the nature of the more ancient records of England:—

Domesday Book. See DOMESDAY BOOK.

The Statutes of the Realm, which commence with the Charter of Liberties of King Henry I., embracing Magna Carta, the other charters of liberties, and all the legislative enactments down to the accession of the house of Hanover, excepting the private statutes in, and subsequent to, the reign of Henry VIII. The peculiar features of this edition are—a text formed upon a collation of the most authentic manuscripts and the best editions, the material variations between them being pointed out, and a careful translation of all the early statutes in parallel columns with the originals, which were generally in French or Latin until the reign of Henry VII.

The Fœdera, a collection of documents entitled treaties, conventions, letters, and public transactions of every kind made or concluded between the kings of England and the various emperors, kings, pontiffs, princes, or communities from 1066 to our time. It is from this source that historians have chiefly obtained their information. The sources whence Rymer obtained the greater part of the materials for this work were the Tower, Chapter-house of Westminster, Cottonian Library, and Chapel of the Rolls.

Calendarium Rotulorum Patentium in Turri Londinensi, or Calendar of the Patent Rolls. The series of these rolls begins with the third year of the reign of King John, and contains an account of the grants of offices, liberties, privileges, lands, honours, creations of peers, restitution of temporalities, confirmations of charters and grants, and all licenses, &c., which pass the great seal. In addition to these subjects, there is hardly any transaction connected with the history or government of this country, or with the most distinguished men of the thirteenth, fourteenth, and fifteenth centuries, which is not referred to.

Calendarium Rotulorum Chartarum, or Calendar of the Charter Rolls in the Tower of London, begins with the first year of the reign of King John, 1199, and ends with the reign of Edward IV., 1483. Their contents differ little from those of the Patent Rolls. Both passed alike under the great seal, but differed in this respect, that a charter was witnessed by such persons as were present when it was executed, whose testimony to its execution was necessary for its validity, whereas a patent was executed by the king himself.

Inquisitiones ad quod damnum commence with the first year of the reign of Edward II., 1307, and end with the thirty-eighth year of Henry VI., 1460. These records are said to have been taken by virtue of writs directed to the escheator of each county, when any grant of a market, fair,

or other privilege, or license of alienation of lands was solicited, to inquire by a jury whether such grant or alienation was prejudicial to the king or to others, in the event of the same being made.

Placitorum in domo capitulari Westmonasteriensis asservatorum abbreviatio, or an Abbreviation of the pleadings during the reigns of Richard I., John, Henry III., Edward I., and Edward II., preserved in the Chapter-house, Westminster. These records contain information concerning the early constitution of Parliament, the *concilium regis*, as well as a large amount of interesting matter illustrative of the history of the country, the descent of the landed property, and the manners and customs of society in the twelfth and thirteenth centuries.

Testa de Nevill, or Book of Fees in the Court of Exchequer in the time of Henry III. and Edward I. This work contains many notices of singular tenures, or the division of property, and by whom possessed during the thirteenth century. It is likewise valuable for the information it affords concerning topography and the history of families. It is not well ascertained from what circumstances these documents obtained the name of *Testa de Nevill*.

Rotulorum Originalium Abbreviatio. This was an Abbreviation of the Rolls of "Originalia," of the reigns of Henry III., Edward I., II., and III., in the Court of Exchequer. Besides giving an account of the cases which came before that court, it contains numerous notices of a historical and antiquarian nature, which throw much light on the genealogies of families, the descent of lands, and occasionally on the manners and customs, as well as on the general state of society, in the thirteenth and fourteenth centuries.

Parliamentary Writs, and Writs of Military Summons. This collection includes all the records which show the constituent parts of the ancient legislative and remedial assemblies of England, beginning with the reign of Edward I., the period when they first assumed a definite organization.

Rotuli Hundredorum, or Hundred Rolls. These rolls are described as containing inquisitions taken in pursuance of a special commission issued under the great seal in the second year of the reign of Edward I. There are reports from the justices in eyre, whose duty it was to inquire into escheats, fees, marriages, wardships, presentations to churches, and usurpations of the rights of the crown, lest the revenue arising from these sources should by any means fall short.

Placita de quo Warranto, or the Pleas of *Quo Warranto*, in the reigns of Edward I., II., and III., preserved in the Court of Receipt of the Exchequer at Westminster. These were closely connected with the Hundred Rolls, and arose in the following manner:—On the return of Edward I. from the Holy Land, he found that the revenues of the crown had been considerably diminished by tenants *in capite* alienating without license; by persons withholding from the crown its just rights, claiming the privilege of holding courts, and oppressing the people in various ways. The king therefore appointed commissioners to take cognizance of these matters, and after having made investigations, to enter these upon rolls, which were for the most part returned to the Court of Exchequer. These rolls were arranged under counties, which included not only Cardigan in Wales, but also the islands of Guernsey and Jersey.

The amalgamation of the State Paper Office, a few years since, with the Record Office proved to be the means of rendering the series of our national archives now an almost complete collection. With the exception of certain documents in the British Museum and in a few public libraries, most of the public muniments of the realm are now placed in one repository, and under the supervision of the Master of the Rolls. One consequence of this incorporation has

been the publication of very valuable calendars and indexes, whereby the most complete and perfect series of records, state papers, and documents of their kind in the civilized world has been rendered easily accessible to students and the public. The venerable Domesday Book itself and state papers from the earliest times down to 1760 are thus available, though the most jealous care is wisely exercised to prevent the least mutilation or suppression.

Some years ago the Royal Commission on Historical Manuscripts was appointed with the view of collecting or obtaining copies of documents that might exist in the libraries of private families, colleges, corporations, and other local authorities, which would be of utility in the illustration and authentication of the history, constitutional law, science, or general literature of the country. The commission was attended with remarkable success, and our national wealth of records has been largely enriched by acquisitions of the highest interest.

To contain the public records a costly building has been erected in Fetter Lane, near Fleet Street, London, in which every possible precaution for their safety has been adopted.

SCOTLAND.—The national records of Scotland are under the charge of the Lord Clerk Register, and are preserved in the Register Office, Edinburgh.

The following is a list of the Records of Scotland, which have been published by authority of the Record Commission of 1831:—

The Acts of the Parliaments of Scotland. The collection of manuscripts under this name contains an account of the parliamentary history of Scotland from the time of James I., with many illustrative historical documents. To each of the printed volumes is added a chronological table of contents, and an index of names and places.

Registrum Magni Sigilli Regum Scotorum, in Archivis Publicis Asservatum. The Register of the Great Seal of the kings of Scotland, preserved among the public archives, 1306 to 1424. This is a collection of Royal Charters of Scotland as far as they have been preserved.

Rotuli Scotie in Turri Londinensi, et in domo Capitulari Westmonasteriensis Asservati. The Scotch Rolls, preserved in the Tower of London, and in the Chapter-house, Westminster. These are important records, illustrative of the political transactions between England and Scotland, commencing with Edward I., 1290, and ending with Henry VIII., 1517. The information they contain is of a very varied nature, consisting of history; political, naval, and military transactions; revenue and trade; biography, &c.

Inquisitionum ad Capellam Domini Regis Retornaturum, quæ in Publicis Archivis Scotiæ adhuc servantur Abbreviatio. An abbreviation of the Inquisitions returned into the King's Chapel, which are preserved in the Public Archives of Scotland, from about 1546 to the end of the seventeenth century.

The ordinary legal records in Scotland, which are divided into two departments—Registration of Records for Preservation, and for Execution—are preserved in the General Register Office. The former of these is merely the preserving of an attested copy of any deed in a public office, so that an authentic copy may be obtained in the event of the other being lost.

IRELAND.—Of the Irish national records the following have been published by the Record Commissioners:—

The ancient *Placita* of Ireland, commencing with the reign of Henry III., and containing an account of the law in Ireland down to the reign of Charles I.

The Patent and Close Rolls of Ireland, which may be said to commence at the close of the reign of Edward I. The information they contain is very various, but has especial reference to grants of landed property, offices, writs, and deeds.

The Pipe Rolls, which commence with the reign of

Henry III., and are chiefly composed of the returns of the receipt and expenditure of the royal revenue, contained in exchequers' and sheriffs' accounts. Besides the information obtained on these points the Pipe Rolls throw great light on the history of private property and the genealogy of the principal persons in the kingdom.

Inquisitiones post mortem, which do not commence before the reign of Elizabeth. Their contents are the same as those of England.

The Irish ecclesiastical documents are of very considerable importance. The most important of these are the Ecclesiastical *Valor* of Pope Nicholas IV., which has reference to the appointments and possessions of archbishops, bishops, &c.; and the *Valor Beneficiorum*, which furnished the rule for ascertaining the tax of firstfruits paid by incumbents of livings in their respective promotions.

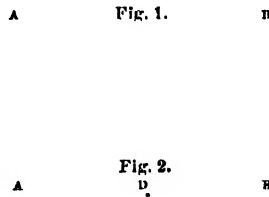
In November, 1852, a number of noblemen and gentlemen were appointed a commission to direct, superintend, and carry into effect the transcription and translation of the ancient records and laws of Ireland, and to prepare them for publication. In accordance with the power thus intrusted to them, the commissioners employed two eminent scholars for the work of transcription and translation. These were the late Dr. O'Donovan and the late Professor O'Curry, under whose superintendence an interesting volume was published in 1865, entitled the "*Senchus Mor*," one of the oldest and most important portions of the ancient laws of Ireland which have been preserved. It exhibits the remarkable modification which these laws of pagan origin underwent in the fifth century, following on the conversion of the Irish to Christianity. Other records of great interest relating to Ireland were subsequently published.

In 1867 the Public Records Act (Ireland) was passed, and a Public Record Office was established in Dublin.

RECOURSE is a term frequently used in a pecuniary sense in commercial transactions. "With recourse" means that the thing sold or bought is guaranteed to prove equal to description or assumption. If it be not, the buyer is to have recourse to the seller (*or vice versa*), and claims that the bargain shall be off, and that he shall be compensated for loss, if any. Sometimes a seller will take a low price for his article if the buyer consents to take it "without recourse," and sometimes an endorser will refuse to incur the liability of the failure of other parties to a bill, and will insist on adding "without recourse to me" to the usual endorsement, in which case he is free from all but his own liability. For instance coupons are usually bought "with recourse," because if the bond is withdrawn or annulled, and the dealer cannot cash the coupons, he has recourse to the person from whom he bought them.

RECRUITING. See ARMY.

RECTANGLE, a four-sided figure, all whose angles are right angles, and whose opposite sides are equal. The rectangle in fig. 1 would be described in geometry as "the rectangle A C B D," or "the rectangle A B C D," or "the rectangle A B A C;" and if the line A B be drawn, and B D set off along it, as in fig. 2, the expression "the rectangle A B C D" is held to mean the area which is fully drawn and expressed in fig. 1, and the trouble of construction and complexity of drawing is saved without damage to the argument. It is evident that the square is a variety of rectangle, with the peculiar characteristic that the adjacent sides, as well as the opposite sides, are equal to each other.



REC'TE ET RET'RO, another name for *Retrograde Imitation*. See IMITATION.

RECURRING SERIES. By a recurring series is meant one of the form

$$a_0 + a_1x + a_2x^2 + a_3x^3 + a_4x^4, \&c.,$$

ad infinitum, in which the coefficients $a_0, a_1, a_2, \&c.$, can each be expressed by means of certain preceding coefficients and constants in one uniform manner; and it is usual to consider only such series as will admit of a linear relation (or one in which only first powers of coefficients enter): thus the series

$$1 + x + 4x^2 + 13x^3 + 53x^4, \&c.,$$

follows the linear law $a_n = 3a_{n-1} + a_{n-2}$. The recurrence in fact is not a recurrence of terms, but of the method of determining terms.

The most simple mode of finding the law of the terms of a recurring series is by the solution of the equation of differences which expresses the relation of the coefficients. This may be verified by decomposing the functions which are developed into the series into fractions with denominators of the first degree, according to the common method used in the integral calculus, and expanding each fraction separately.

RED CHALK, a thin bed of deeply-coloured earthy limestone occurring in the cretaceous formation of Norfolk and along the base of the wolds of Lincolnshire and Yorkshire. This remarkable deposit, which is well exposed in the cliffs at Hunstanton, rests immediately beneath the true white chalk, and is underlain by coarse NEOCOMIAN sandstone of a yellowish-brown colour, locally known as "carstone." It therefore occupies the same stratigraphical position as the thick accumulations of GAULT, GREENSAND, and CHALK MARL of more southern areas. Whether, however, it is the precise representative of these formations, is at present an unsettled point, and some geologists have even suggested that it ought properly to be classed with the white chalk itself. Fossils are numerous—especially Belemnites and Terebratulæ—and many of the species are Gault forms, while others agree with those of the chalk above. A curious branching structure, which bears the name of *Spongia paradoxa*, but is probably of inorganic origin, is conspicuous both in the red chalk and the superjacent white stratum; and there are numerous fibrous-looking fragments of large Inocerami. The colour of the rock is of course due to the presence of oxide of iron, but opinions differ as to the source whence it was obtained. It has possibly been derived from the decomposition of the green silicate GLAUCONITE, which occurs in grains in the chalk marl, and largely enters into the composition of the greensands. (For detailed descriptions and references to the literature of the subject, see Mr. Whitaker's presidential address to the Norwich Geological Society, 1883.)

RED CRAG, a deposit of ferruginous sand, with numerous intermingled fragments of shells, representing the lower division of the *PLIOCENE* formation in Suffolk and Essex. It rarely exceeds 20 feet in thickness, and is well exposed in the cliffs of Felixstow and Walton-on-the-Naze. At the last-named localities it rests directly upon the London clay, but in other parts the CORALLINE CRAG is frequently interposed between the two. The fossils of the Red Crag prove it to be of marine origin, and are suggestive of its having accumulated in the form of shoals resembling the Dogger Bank and others at the present day. Many of the shells belong to types now restricted to the warmer seas; and the assemblage of species differs to such an extent in different localities that it is probable that the deposits are not all precisely of the same age. The beds at Walton are especially remarkable for the abundance of the "reversed whelk" (*Trophon antiquum*) and *Pectunculus glycymeris*. At and near the base of the

formation, there occurs a stratum of phosphatic nodules and fossil bones, which form a valuable manure; among these are remains of several large quadrupeds, including the mastodon, hipparion, rhinoceros, tapir, walrus, and sea-cow (*Halitherium*). Most, if not all, of the latter are derived from the wreck of Miocene deposits, and there are also numerous phosphatized fish-teeth and bones undoubtedly washed out of the earlier London clay.

RED LEAD or MINIMUM. See LEAD.

RED OCHRE, a name given to a pigment obtained by calcining yellow ochre; the colour is due to peroxide of iron.

RED RIVER or RIO ROX'O, a river of the United States, North America, rises in the north of Texas, at an elevation of 2500 feet above the sea; flows at first east, forming the boundary between Texas and the Indian Territory; then south-east through Arkansas and Louisiana, and falls into the Mississippi, 128 miles north-west of New Orleans, after a total course of about 1200 miles. Its principal tributaries are the Washita and the False Washita, from the north. The channel is blocked for more than 45

miles by collected drift timber, which has hitherto defied all efforts at removal.

RED RIVER SETTLEMENT. See MANITOBA.

RED SAUNDERS. See *PTEROCARPUS*.

RED SEA. This sea is a portion of the Indian Ocean, with which it is connected by the Gulf of Aden and the Strait of Bab-el-Mandeb. Its length exceeds 1400 miles, and its surface is nearly 180,000 square miles. The width at the Strait of Bab-el-Mandeb is about 20 miles, but at the widest point it is nearly 230 miles across. Of the two arms into which the Red Sea branches off at Ras Mohammed, the eastern is called Bahr-el-Akaba, and the western Bahr-el-Suez. Between these two gulfs is the mountain-region of Mount Sinai or Gebel Mousa (Mount of Moses). The Bahr el-Akaba branches off in a north-eastern direction, and extends more than 100 miles, with an average width of less than 15 miles. The Bahr-el-Suez runs in a north-by-west direction to its extremity at the town of Suez, a distance exceeding 180 miles; its average width is 20 miles.

The Red Sea is of great depth, amounting in some places



Entrance to the Red Sea.

to 230 fathoms. The navigation is rendered difficult by islands, reefs, and sandbanks, by sudden changes of wind, and heavy gales. The islands, of which there are several rocky groups, are chiefly near the eastern shore. The Red Sea is the most northern portion of the ocean in which coral reefs occur, and they are more numerous than in any other part of equal extent. With a coast-line of 4000 miles, it does not receive a single river, and scarcely even a rivulet enters; the greater part of its surface is in the most arid region of the globe, and very little of the water which evaporates from it returns again in rain or by rivers, yet it is not shrinking, and there must be therefore a constant supply maintained by a current from the Indian Ocean. If it were not so, and if the strait were closed, it is estimated that the level of the sea would be reduced by

evaporation 23 feet per annum. The specific gravity at Suez is 1027, and at the mouth, 1023; and the saline contents at these places 39.2 and 41 parts in 1000, or about 4 per cent. by weight, or 2.7 per cent. by bulk. It seems hence obvious that, unless under-currents existed, the whole sea would speedily become a mass of solid salt. If the entrance were closed, the loss being about 23 feet per annum by evaporation, it would be dried up in about 60 years. The surface waters vary in temperature from 65° to 85° Fahr., the air being very rarely below 75°, and often as high as 90°. In November, 1876, Dr. Buist recorded surface temperatures on four successive days of 100°, 104°, 100°, and 96° Fahr., the temperature of the air at the same time being 80°, 82°, 83°, and 82°; but here, perhaps, volcanic activity may account for the extraordinary sea

temperatures. The rise of tide is trifling, owing to the narrowness of the opening, being no more than 2 to 3 feet at Suez. Dr. Schweinfurth calls attention to the remarkable fact, that during the cooler season of the year, when the north-east monsoon causes a strong westerly set into the funnel-shaped Gulf of Aden, and thence through the straight into the Red Sea, and when evaporation is least, that the level of the Red Sea is *lowest*, as is shown by the exposure of the coral banks. This apparent anomaly is explained by remembering that the narrowing of the Gulf of Aden will cause a "head" of water to accumulate on the outside of the strait; and this, producing an under-current in the opposite direction, will tend to increase, as by a *cis à fronte*, the under-current which carries out the dense water of the Red Sea, and thus to lower its level.

The Red Sea occupies the lowest portion of a deep valley which lies between the elevated table-land of Arabia on the east, and the high lands of Abyssinia, Nubia, and Egypt on the west. The outer edge of these table lands is generally from 10 to 30 miles from the shores, and has the appearance of a continuous mountain range, varying in height between 3000 and 6000 feet. The space between them and the shores is partly occupied by hills, which skirt the edge of the table-land, and partly by a low and level tract along the sea, which is generally sandy, but sometimes swampy. The position of these table-lands has great influence on the direction and force of the winds which blow over the surface of this sea.

The principal harbours on the Arabian shores are Mocha, Hodeida, Jeddah, and Yembo; those on the African are Suez, Cosseir or Cosir, Suakim, and Massowah. There is an active communication kept up between these places, especially by the numerous pilgrims who visit Mecca and Medina from the eastern countries of Africa.

The Turks appear to have a claim to supremacy over both shores of the Red Sea, but the English, by means of Aden and the Island of Perim, control the entrance at the straits of Bab-el-Mandeb. The French have secured territory at Obok, with the idea of establishing a commercial port. The exact position of this port is $11^{\circ} 57' N.$ lat., and $43^{\circ} 15' E.$ lon. It is under 6 miles from Ras Bir, 16 miles from the British island of Musha, at the entrance of the bay, 58 miles from Perim, at the entrance of the Red Sea, and 115 miles from Aden. The Italians also have establishments at the Bay of Assab and at Massowah.

The first mention of the Red Sea occurs in the Bible on the occasion of the Israelites passing through it. Soon after that time, if not before, it seems to have been navigated. In the time of Solomon the advantages of such a navigation were well understood.

The Jews and Phœnicians appear to have carried on an extensive trade upon this sea; and after the destruction of the Persian Empire it resumed importance as the principal route of traffic between Europe and the East, which distinction it retained until the discovery of the passage round the Cape of Good Hope. The commerce and navigation of the Red Sea were for a time nearly annihilated by this event, but the making of the SUEZ CANAL restored it to this, its old channel.

The south-east monsoon blows constantly for eight months of the year, and during the remainder the north-west monsoon. From October to May, when south winds prevail, the water rises in the north part of the sea, which then attains an elevation much higher than the Mediterranean; but it has been ascertained that the low-water mark of both seas is identical.

The origin of the name of the Red Sea has given rise to a variety of conjectures, and has never been satisfactorily settled. It is generally believed that it was so called either (1) from the abundance of red coral and pink-coloured *fuci* found in it, the reefs being distinctly seen in consequence of the singular clearness of the water; or (2) from the ancient country of Edom (meaning *red*), which was on its east shore; or (3) from the blood red colour frequently imparted to it by animalculæ. The Hebrews called it *Yam Sûph* or Sea of Weeds.

RED SNOW (*Protococcus nivalis*) was first investigated by Saussure, who observed snow in the Alps of a red colour in the year 1760. He tested it chemically, and found it to be due to some vegetable substance. It was again seen by the Arctic explorers under command of Captain Ross at Baffin's Bay for a distance of 8 miles, and some of it being brought to the celebrated botanist, Robert Brown, he determined it to be a unicellular ALGA.

REDAN is the simplest kind of work employed in field fortification, and consists generally of a parapet of earth divided, on the plan, into two faces, which make with one another a salient angle, or one whose vertex is towards the enemy. Existing alone, the work is capable of making but a feeble defence, but it is of use as an outpost, to afford a momentary cover for troops who are to retire when a superior force advances against them. A redan may, however, be advantageously placed to cover the head of a bridge, the entrance into a village, or defend the ground in front of some strong redoubt; a series of them may also be constructed along the front of an army, in order to strengthen the position and cover the artillery. Redans figured largely in Wellington's works for defending Lisbon in 1810, and in Marshal Soult's plans for the defence of the south of France in 1813. The redan of Sebastopol in 1855 was the principal point of the English attack, and the scene of two sanguinary repulses by the Russians in June and September. See FORTIFICATION.

REDBREAST (*Erithacus rubecula*) is a well-known British bird belonging to the family of Warblers (Sylviidae). Though numbers remain in this country throughout the year, the redbreast is a true bird of passage, and on the continent of Europe, especially in the more northern parts, its migrations are well marked, many passing the winter in Northern Africa. The "robin redbreast," as this bird is affectionately called in Britain, is too well known to need description. In every place where he occurs he is regarded with a greater degree of favour than is shown to any other wild bird; his red breast and bright eye seem to make him friends wherever he goes, and the affection with which he is welcomed at the cottage door is heightened by the boldness and sprightliness of his habits. In the winter, especially when his favourite food is scarce, and the places where he might seek it covered up with snow, the robin seems, as it were, to cast himself upon the charity of man, not only coming about human habitations to pick up what he can, which is done by many other birds, but actually coming to show himself on the window sill or threshold, as if asking to have his wants supplied. Even in the breeding season, when most birds become very shy, the robin does not lose his confidence in man, but builds his nest either in the hedgerow or about the sheds and outbuildings, sometimes in places where a considerable amount of bustle is going on. The nest is cup-shaped, and composed of moss, leaves, and grass, lined with hair and feathers; it contains from five to seven eggs, which are white, with pale reddish-brown spots; two or three broods are produced in the season. The song of the robin is very sweet, though not very powerful, and is continued from spring to late in autumn.

Our kindred beyond the seas have given the name "robin" to several birds that reminded them of the little redbreast of the mother-country. The robin of Australia are species of an allied genus, *Petroica*. The blue robin of the United States is another allied species (*Sialia sialis*) greatly resembling the redbreast in form and habits, but having the upper surface light blue instead of olive brown. Another robin of the United States is a species of thrush (*Turdus migratorius*) having a dark orange breast.

RED'DITCH, a town of England, in the county of Worcester, 130 miles from London by the Midland line, and 12½ S.S.W. of Birmingham, is situated in a fine district, and is remarkably well built. The inhabitants are chiefly employed in the manufacture of needles, pins, fish-hooks, and fishing-tackle, which are made to a large amount and of superior quality. Young women are principally engaged in the work, and in addition to the large English demand, immense quantities are exported. Redditch contains two churches, a fine Roman Catholic and other dissenting chapels, county court, and literary institute. The population in 1881 was 9961.

REDDLE, RADDLE, or RUDDLE. See OCHRE.

RED-EYE. See RUDD.

REDHILL, more properly *Warwick Town*, a town of England, in the county of Surrey, 1½ miles from Reigate and 21 from London, is best known from its reformatory farm school, which has an average of 300 boys, and which has proved eminently successful. At Earlswood, close by, is the Asylum for Idiots, which contains about 600 children. Redhill, not many years since a mere hamlet, is now a considerable town, and promises even to exceed Reigate in size and importance. There are several churches and dissenting chapels, a corn-exchange, with assembly rooms, &c. The population in 1881 was 11,266.

REDOUBT is a general name for nearly every kind of work in the class of field fortifications: thus a redan with flanks, a parapet inclosing a square or polygonal area, a work in the form of a star, and a fort with bastions at the angles, are occasionally so called; but the second of these is the work to which the term is more particularly applied, for an account of which see under FORTIFICATION.

REDOWA, the English name of the national Bohemian dance, the *rejdivok*, introduced (with modifications) into Paris about 1846. The *rejdivok* is properly partly in duple and partly in triple time in alternating sections, but in its modification as the *redowa* it is wholly in rather slow triple time, and becomes somewhat like a mazurka in spirit, and like a very slow waltz in dancing.

RED'POLL is the English name of two species of birds nearly allied to the LARKS, and by most naturalists placed in the same genus (*Linota*), though others make them the types of a distinct genus (*Agiothus*). The Common or Lesser Redpoll (*Linota rufescens*) is to a certain extent a migratory bird in this country; for although it is a permanent resident in Scotland, and even in some of the northern counties of England, by far the greater number of those seen in Britain come to us in the autumn from the more northern parts of Europe. It is a diminutive bird measuring little more than 4 inches in length; the general colour of its plumage is brown, palest beneath; the back is spotted with dark brown. The quill feathers of the wings are nearly black, but edged with pale brown; the chin is black, and the flanks streaked with dark brown. The forehead is deep crimson, and the breast of the male is strongly tinged with red.

This elegant little bird has a very wide geographical range, extending apparently throughout the northern parts of both hemispheres. It is found abundantly in the Arctic regions, and visits the inhospitable shores of Spitzbergen. During its winter residence in Britain the redpoll is seen in considerable flocks frequenting woods and plantations, where it feeds upon the seeds of various trees, especially the birch and the alder. In summer it feeds largely, like the goldfinches, on the seeds of the thistle, groundsel, dandelion, and other composite plants. Its nest is built in a bush or low tree, and is composed of moss, grass, and the down from the catkins of the willow; the latter substance also forms the lining, and furnishes a soft and warm bed for the eggs and young. The eggs are four to six in number, varying from dirty white to deep greenish-blue, spotted with red. It is a familiar and affectionate

little bird, and may be easily trained to perform a few tricks, for which reason it is often kept in confinement, although its song is merely a feeble twittering.

The Mealy Redpoll (*Linota linaria*) is a larger species than the preceding, which it closely resembles in general appearance. It is found in the northern parts of both hemispheres, migrating towards the south for the winter; at which season it occurs, although seldom in any abundance, in Britain.

A third species, the Arctic Redpoll (*Linota hornemanni*) inhabits the extreme north of America, being resident in Greenland throughout the year: it has been on a few occasions taken in Britain and on the continent of Europe.

RED-ROOT. See CRANOFIUS.

RED'RUTH, a town of England, in the county of Cornwall, 8 miles W.S.W. of Truro, and 311 by rail from London. The town owes its chief importance to its being the centre of the West Cornwall mining district. It has brewing and safety fuse works, a town hall, miners' hospital, two churches, and a mining exchange. In the neighbourhood are interesting Druidical remains and a Norman castle. At Redruth, in 1792, William Murdoch first employed coal gas as a light. He is said to have not only illuminated his house by this means, but also to have carried about a bladder of gas on dark nights to light him along the roads. The population in 1881 was 9335.

RED'SHANK (*Totanus calidris*) is a bird belonging to the snipe family, SCOLOPACIDÆ. The redshank, though less common than formerly, is a resident in Britain throughout the year. It is widely distributed throughout Europe and Asia, and is also found in Northern Africa. The redshank is about 11 inches long. In its winter plumage the upper surface is ashy brown, with the primaries nearly black, the rump white, and the tail barred with gray; there is a white band on each wing, and the under surface is white, with a few dusky streaks. In summer the back, and especially the wings, are mottled with dark brown, and the breast is streaked and spotted with black. The bill is dark red, with the tip black; the legs are orange red. During the winter the redshanks are seen in flocks on the sea-shore, seeking small marine animals by probing with their bills into the wet sand and mud. In the breeding season they go inland, resorting to marshes and river-banks. The nest is composed of coarse grass, and concealed in a tuft of rushes or grass; the eggs are four in number, reddish-brown, with black spots and blotches.

The Spotted Redshank (*Totanus fuscus*) is a larger species, and is only seen in Britain on its passage to and from its breeding grounds. In the breeding season the head, neck, shoulders, and breast are deep black, the back and rump being a pure white; the legs are crimson. In the winter its plumage resembles that of the common redshank.

RED-SPIDER. See ACARIDÆ.

RED'START (*Ruticilla phæniceus*) is a British bird belonging to the family Sylviidæ (Warblers), and nearly allied to the REDBREAST. The redstart is a summer visitor to this country, where it is generally distributed, but by no means abundant. It is very rare in Ireland. It is widely distributed over Europe in summer, crossing over to Africa for the winter. In its general habits it resembles the robin, and like it jerks its rather long tail up and down at every movement; it is from this habit and the red colour of the tail that it has received the name of redstart (Old English *steort*, tail). The male redstart is lead-gray above and pale chestnut beneath, with the throat and face black, the forehead white, and the tail reddish-chestnut; the female has neither black nor white on the head, and her colours are paler than those of the male. The whole length of the bird is rather more than 5 inches.

The redstart is an active and lively bird; it haunts woods, hedgerows, and orchards, and is said to be very

partial to old walls covered with ivy. Its food consists, like that of the robin, of worms, insects, spiders, and fruits. Its song is soft and sweet. The nest is composed of moss and lined with hair and feathers, and placed usually in a hollow tree or a hole in a wall. The females usually lay from five to seven eggs, which are of a pale greenish-blue colour; and the birds sometimes produce two broods in a season.

• Another species, the Black Redstart (*Ruticilla titys*), distinguished by its sooty black breast, is very common in gardens on the Continent, and occurs in England chiefly near the south coast in autumn and winter. Two other nearly allied species, the Bluethroats (*Cyanecula svecica* and *Cyanecula leucopynea*) are occasionally taken in England, the former more frequently than the latter; both species have blue throats, in the middle of which in the former is a bright bay spot, in the latter a white spot.

In the United States the name redstart is given to the *Setophaga ruticilla*, a bird of the family Mniotiltidae or American Warblers. Though closely resembling the European redstart in appearance it is very different in character and habits.

REDUCED THREE PER CENTS., the name of a well known fund of government annuities, originally issued at 4 per cent., reduced in 1746 to 3½ per cent., and in 1757 to 3 per cent. In 1886 their entire sum amounted to £77,151,474.

REDUCTIO AD ABSURDUM. See ABSURDUM, REDUCTIO AD.

REDUCTION. This term is used in arithmetic in the well-known sense of the operation of turning one denomination of weights or measures into another; thus shillings may be reduced to pounds, or pounds to shillings. It is also used in the same sense throughout analysis, namely, that of bringing one form into another, making one question depend upon another, &c.; in fact, for transformation generally. •

RED WING (*Turdus iliacus*) is a species of THRUSH (*Turdus*) so-called from the bright reddish-orange of the sides of the body, inner wing-coverts, and axillaries. The redwing is a winter visitor to this country and to all the southern parts of Europe, passing the summer and breeding in the north. It breeds in Iceland, Scandinavia, Northern Russia, and Siberia, visiting in the winter Europe, Northern Africa, and the temperate parts of Western Asia. It is rather smaller than the song thrush, and is of a rich clove-brown colour above and whitish beneath, having the breast and belly spotted with dark brown in the same way as the song-thrush; there is a white streak over the eye. It arrives in England about the middle of October, taking up its abode among the trees in our parks and pleasure grounds. The food of this species consists of insects, worms, and slugs, but it scarcely seems to eat berries, and in severe weather the redwings are observed to be the first birds that suffer. The song of the male is pleasing, but not comparable to that of the song-thrush. The external part of the nest consists of dried heaths, with which fine twigs and moss are sometimes mixed, and outside all is often a quantity of lichens; this is lined with a layer of dirt, and then comes a soft bed of fine grass, on which the eggs, four to six in number, are deposited.

REED, ANDREW, a nonconformist minister, greatly distinguished for his philanthropic activity, was born in St. Clement Dane's parish, London, 1787, educated at Hackney, and in 1811 appointed minister of Wycliffe Chapel, Stepney, where he preached for fifty years. His strongest claims to the grateful remembrance of posterity are due to his exertions in founding the London Orphan Asylum at Clapton in 1813, the Infant Orphan Asylum in 1827, and the Asylum for Fatherless Children at Redham, near Croydon, in 1847. To these noble labours were added the establishment of an Asylum for Idiots, at Earls-

wood, Surrey, and the Royal Hospital for Incurables. He died at Hackney on the 25th of February, 1862. His son, Sir Charles Reed, was long chairman of the London School Board, and also a very ardent philanthropist of a practical kind.

REED INSTRUMENTS, MUSICAL REEDS.

Since all musical sound is produced by recurrent impulses upon the air, it is manifest that a thin flexible bent strip of metal or cane placed before the aperture in a pipe through which the wind enters, will cause a musical tone, if sufficiently elastic. For by the air forcing it against the pipe the inrush of air is stopped, and by the elasticity of the reed forcing it outwards again to its curved form, the air is admitted. Thus a flickering alternation is produced, and is converted from noise to musical sound by the pipe itself, which selects from this flicker the precise rate of vibration answering to its own length, and "speaks"—that is, controls—the vibration of the reed to that rate, and gives forth the tone connected with all pipes of that length. This is a "beating reed," such as is used in organs. The "free reed" of the harmonium and American organ has its tongue just narrow enough to swing to and fro in the aperture or "box," and at the middle point of each passage practically closes the aperture. Organs, harmoniums, American organs, concertinas, accordions, &c., have metal reeds, usually of fine rolled brass, but occasionally of steel.

The reeds of orchestral instruments, clarinet and saxophone (single), oboe and bassoon (double), are really made of a cane-like reed, and explain therefore the origin of the name. The commonest sort are of cane, but the best reed yet found is the silicious layer of a tall reedy grass of South Europe, called *Arundo Donax* or *Sativa*, and its chief supply comes from Fréjus on the Mediterranean. Laneewood, thin ivory, ebonite, &c., have been used, but as yet nothing equals the sativa. In the clarinet and instruments of the saxophone family, which have one reed, the lip presses the reed with a gentle firm pressure towards the aperture till the requisite closeness is attained and the beating made possible (but in the clarinet, unlike the organ-reed, the reed never actually strikes the sides of the aperture); in the oboe and bassoon the lips press two reeds neatly together, the breath passing between them into the pipe, and the reeds being so arranged as to close the aperture when they swing together, and leave it open when they swing apart.

The horn, trumpet, trombone, cornet, &c., are played with the lips pressed into a cup-shaped mouthpiece, and so formed into an elastic double-reed, which the breath, driven through them at considerable pressure, causes to flutter, out of which fluttering or trilling the pipe selects its own rate, into which the lips then fall and steadily vibrate at the rate per second characteristic of the note being uttered. Babies often trill the lips in this way naturally. The human larynx, as used in singing, is also very similar in its action to the lip reed of the trumpeter, as the voice is produced by the vibration of the "vocal chords," the larynx being the orifice of the sounding tube, and the throat and mouth the tube itself.

REED-MACE or **GREAT CAT'S-TAIL** (*Typha latifolia*) is a very handsome aquatic, and grows abundantly in damp marshy places. The leaves are 3 feet in length and an inch in width. When the densely-crowded spike is brushed and a lighted candle applied near it, a sudden flash is produced. This arises from the firing of the pollen that is diffused in the air. *Typha angustifolia* (lesser cat's-tail or reed-mace) is less frequent than the last species. The two genera, *Typha* and *Spartanium*, belong to the order Typhaceae among the MONOCOTYLEDONS. They are herbaceous plants, growing in marshes and ditches. The genus *Typha* is known by the male and female flowers being both seated on the same spike, the male flowers being uppermost.

REEDS. See ARUNDO; PIRAGMITES.

REEFING. In navigation, to *reef* is to diminish the surface of the canvas exposed to the wind. Sails attached to yards are reefed at the head. Stout horizontal bands of canvas, from 3 to 6 feet apart, extend across the sails; of these, which are called *reef bands*, there were usually ten in the foresail and mainsail, and four in each topsail; but the whole system of reefing is now being gradually changed by the growing use of double topsails and other ingenious appliances. The reef-band is commonly pierced with two holes in each breadth or "cloth" hole of the sail; through each is drawn a short piece of rope, so placed that one end hangs before and the other abaft the sail, thus forming two *reef points*.

When the sail has been lowered and trimmed to the wind so as to flap or slinke freely, the extremities of the reef-band are drawn up towards the yard-arm by the ropes called *reef tackles*. The men then stretch out upon the yard, supporting their feet on the foot ropes, and gathering up the loose canvas of the sail till they reach the reef-band, keep the latter taut along the yard until they have "passed" or secured the *earings*, beginning from the weather side; then they tie the two reef points of each pair together over the yard, and the sail is reefed, the surface having been thus diminished by the depth of one reef. Gaff sails are reefed at the foot; the sail being lowered and slackened, the caving in the after band is hove down within reach of a strong rope called a *reef pendant*, and the men then tie the points under the sail.

The operation of reefing is always attended with inconvenience, and in stormy weather with great danger. Apparatus for reefing sails from the deck, by rolling them upon the yard, is a great desideratum, and its construction has often been attempted, hitherto not with complete success.

REEL (Gaelic *righil*, a dance), a national Scottish dance. The Danish *kreol* is not unlike the Highland reel in its nature as a lively dance in couples with much gesticulation and springing steps, and possibly the two words may have some immediate connection not yet fully made out. True Scots declare, of course, that Scotland taught the reel to Scandinavia. The Gaelic word is undoubtedly of the same ultimate origin as the Old English *hreol*, our modern *whirl*, and the Danish *kreol* is but another variety of the latter word.

The music is always in 8 bar phrases, but is sometimes in 4-4, and sometimes in 6-4 time. There is a slow variety of the Scotch reel, called the *Strathspey*, and a fast variety which is danced in Ireland. The figures are so various in the different versions of different localities as hardly to be brought to any common description; but the general characteristic of the dance is the continual formation of figures of eight by the dancers in diverse fashions, the partners of each couple always dancing face to face.

REEVE (Old English *gerefa*, from *raf*, famous), the chief officer in earliest English times. The town-reeve (*tun gerefa*) was chosen by the citizens, or occasionally he would be nominated by the king. In later times, when townships fell under single proprietors in great part, the reeve was nominated by the great landlord. This was increasingly the case when the Normans came into power. At the great half-yearly shire-motes, the town-reeve of each township, with the priest and four representatives, made up the local representation, twelve representatives being added from each hundred mote. The latter met once a month, and the town-reeve and the five others from each township attended it.

The shire-reeve or sheriff was the chief royal officer of the county, as we should now say the lord-lieutenant, but with far larger powers than our lords-lieutenant have. He presided at the shire-mote, assisted by the bishop of the shire and the caldorman.

REFLECTION OF LIGHT. When a ray falls upon a mirror, the ray is bent from its original position into a different direction, and the act of changing the direction of the ray is termed *reflection*. Let AO (fig. 1, Plate) represent a ray of light which falls upon the mirror CD , supposed for the present to be a flat plane. After reflection the ray AO travels in the direction ON , which is defined by what are known as the laws of reflection. Draw a line OR perpendicular to the surface of the mirror, then the first law of reflection states that the reflected ray must lie in the same plane which contains the incident ray AO and the normal OR . The second law says that the angle ROA , between the normal and the reflected ray, must be equal to the angle AOR , between the normal and the incident ray. It will be observed that these two laws completely define the course which each ray is to pursue after reflection. We can extend the results to curved mirrors by the consideration that each curved mirror may be regarded as coincident with its tangent at the point of reflection, so that, replacing the curved surface by the tangent plane, the laws of ordinary reflection from a plane may be applied.

Let BAM (fig. 2) represent a section of a spherical mirror, and let OM be a ray of light which, diverging from O , falls upon the mirror at M ; draw GC to C , the centre of the mirror; then if a tangent plane were drawn to the mirror at M , it is obvious that MC would be a normal to that plane, and therefore the reflected ray must lie in the plane containing OM and CM . From the second law it follows that the reflected ray MF must make with the normal MC an angle, FCM , equal to OMC , and thus the point F is determined in which the reflected ray intersects the axis of the mirror.

As the triangle OMF has its vertical angle bisected by MC , it follows from a well-known proposition, that the segments OC and FC , into which the line OC is divided, have the same ratio as the lines OM and FM . Now, when the mirror BAM is small in comparison with the radius AC , we may practically regard MF as nearly equal to AF , and OM as nearly equal to OA . In this case the ratio OM to FM is the same as the ratio AO to AF , and thus we deduce the proportion:—

$$\frac{OC}{OC} : \frac{FC}{AO} = \frac{AO}{FC} : \frac{AF}{AF}.$$

From this proportion it is very easy to find the path of each reflected ray. Being given the point O we know, of course, the points C and A , being the centre and the surface of the mirror; it is then only necessary to divide the line CA in the ratio of OC to AO in order to find F . It will be observed that in this determination no reference is made to the inclination of OM to OA , except that it be small; it therefore follows that all the rays which diverge from O at small angles will after reflection, be brought together again at F . Thus F is the point called the focus of the mirror, to which all the rays are concentrated.

If we allow the point O to be at a very great distance—suppose, for instance, that O be a star—then the ratio CO to OA is for all practical purposes unity, and therefore the point F must simply bisect the radius AC . In a case of this kind, when the point O is enormously far off, the rays are sensibly parallel, and thus we are led to the important result that a parallel beam of rays impinging on a spherical mirror are brought to a focus at a point which is half a radius distant from the surface of the mirror.

It is, however, necessary to observe that *all* the parallel rays which fall upon a spherical mirror will not be brought to the focus; it is only absolutely true of those rays which fall actually at the centre of the mirror; it is approximately true of the rays which fall very near thereto, and the difference increases more and more as the rays depart from the centre. Thus, in fig. 3, which represents a hemispherical mirror receiving a parallel beam of rays,

all the rays after reflection intersect to form the beautiful curve known as a *caustic*; but the rays are specially concentrated at the centre of the caustic *n*, and all the rays which are near the centre pass after reflection, for all practical purposes, through the focus *n*; the rays which fall at a distance of many degrees cannot be said to pass through the focus, so that spherical mirrors in which accuracy is required should only be very small in comparison to their radius. It is, however, theoretically possible to have a mirror which shall convey all rays to a focus. If the mirror, instead of being spherical, were formed by the revolution of a parabola round its axis, then every ray parallel to the axis which fell on the parabola would be reflected to the focus. Conversely, if light diverged from the focus of a parabola and fell on the reflecting surface, it would, after reflection, emerge as a parallel beam. This principle is made use of when it is desired, as in the case of the old-fashioned lighthouses, to concentrate all the diverging light from a lamp into a single parallel beam. For accurate optical purposes it is difficult to fashion a parabola. It is, therefore, more usual to replace the parabola by its osculatory sphere, and when the segment of the sphere which is employed is only a very small fraction of what would be the entire sphere, then all needful precision can be attained.

Let *A B* (fig. 4) be a plane mirror, in front of which is an arrow *D D*, the reflection of which is observed by an eye placed at *o*. The rays from the point of the arrow at *D* form a diverging beam which falls on the mirror at *x*, and after reflection proceed to the eye at *o*. The eye receiving these rays in the direction *M O*, sees the arrow-point in that direction just as if the arrow were actually placed behind the mirror. The position of the image of the arrow is found by letting fall *D A* perpendicular on the mirror, and making *A F* equal to *A D*. It is shown that the triangles *M A D* and *M A F* are equal to each other, so that the beam *M F*, produced, will make, with the side, *M D*, of the mirror the same angle as *M D* makes with *A D*. The same will be true for each of the other rays diverging from *D*, and therefore it will appear to the eye as if the point of the arrow was at *F* instead of *D*. In a similar manner the other end of the arrow produces an image at *F'*, and thus the whole arrow is simulated at the other side of the mirror.

If *D B* (fig. 5) be a curved spherical mirror with a centre at *A*, and if *o q* be an object in front of the mirror, then an image of the object is formed near to the mirror, in accordance with the law of reflection by curved mirrors. From the point of the sword at *o* the rays diverge, which, falling on the mirror, are brought to a focus at *a*. In a similar manner, the handle of the sword at *q* forms an image at *q*, so that the image of the sword is in this case another smaller sword turned upside down. To actually see these images, however, it is necessary to have very special arrangements, for which see TELESCOPE. The sword itself radiates light in all directions, and can be seen from every side; but the rays of light which form the image only travel in certain special directions, and unless you can place your eye in the proper position to catch these rays you cannot see the image. The figure must, therefore, be received with caution, for it is not to be supposed if a sword were placed in front of the mirror, and if you looked at it broadside, as the figure suggests, that you would see the image.

A convex mirror can also produce an image. Thus the point *o* (fig. 6) radiates light, which, after reflection at *n*, appears to diverge from a point, *a*, behind the mirror. In a similar manner *q* has a focus at *q*, and the sword *o q* has thus an apparent image, *o q*, at the rear of the mirror. See also HEAT, SOUND.

REFLEX MOVEMENTS are those which are due to stimuli, but are unconsciously performed, such as

sneezing, coughing, winking, &c. Probably the higher the animal in the scale of beings the more are its actions dependent upon its will, and the less upon external stimulus unconsciously received. Nevertheless, in man, the highest of animals, large departments of action remain purely reflex. Respiration, controlled by a respiratory nervous centre in the medulla oblongata, is a great example of modified reflex. Circulation, though quite unconscious, is however automatic and not reflex in its nature. That is to say, while the medulla moves the ribs and diaphragm because it is stimulated by the need of aeration in the blood—that is, by an external stimulus, as when one breathes quicker on a hill-top—the heart, to a very large extent, carries its stimulus within itself. The heart of a cold-blooded animal will beat for hours, sometimes for days, after removal from the body.

The best and most numerous examples of reflex action in the human body are, however, those due to the spinal cord; in fact, reflex action has been said to be the main function of the cord, and its gray matter to be properly regarded as a multitude of reflex centres. It is, in fact, the type of reflex action, with all the five characteristics complete. These are (1) a sentient surface, (2) a sensory (afferent) nerve, (3) a nerve-cell, (4) a motor (efferent) nerve, and (5) a muscle. The sensory impulse traverses this course, and is converted by the nerve centre into a motor impulse without the brain necessarily knowing anything of the matter. Or one sensory impulse may give rise to many motor impulses, as when a slight tickling in the throat, due perhaps to a hair, brings on a violent fit of coughing, throwing into action a large number of muscles of the entire body.

The perfectly brainless or non-volitional character of these movements is shown by the laboratory experiment of removing the brain from a frog, and touching the skin of the body with acid, or pinching it, whereupon the leg will be vigorously moved in efforts to wipe away the stimulus. In fact the action will be made even more perfect by the removal of the brain. This brings us to the fact that the action of the brain largely reduces the field of reflex action. We are able by an effort of will frequently to stop actions which, when we are not preventing them, occur freely. We can remain still under tickling, or control the eyelids from winking, &c. We may be said in this to foster the brain at the expense of the nervous system generally; and as a matter of fact reflex actions are more perfectly accomplished in the case of children than of adults, and in the case of savages than of higher races.

REFORM ACTS are the names given to important Acts passed for the improvement of the representation of the people, in 1832, 1867, and 1885. Although, however, the subject of reform was only brought to an issue in the first-named year, it had for a long period formed the topic of popular agitation. In 1745 Sir Francis Dashwood moved for reform of the representation in vain; and in 1770 the great Lord Chatham failed in an attempt to add a third member all round to the counties to counterbalance the corruption of the boroughs; in 1776 Wilkes proposed to disfranchise the rotten boroughs, and give their members to growing towns as yet totally unrepresented, such as Manchester and Leeds; in 1780 the Duke of Richmond brought in a bill for annual Parliaments, universal suffrage, and equal electoral districts, but withdrew it without a division. In 1782 Mr. Pitt endeavoured to carry a measure disfranchising the rotten boroughs and giving their members to the counties, but was defeated by a majority of twenty. In the following year the majority against it was 144, and seventy-four in 1785. The excesses of the French Revolution caused a reaction, and nothing further was seriously attempted for many years; though in 1790 Mr. Flood moved for 100 new members to be added on Lord Chatham's old principle, and Mr. Grey moved in

1793-97 for more county members, lower county franchise, and borough household franchise. In 1809-17-18-19 Sir Francis Burdett moved for reform—equal electoral districts, annual parliaments, and universal suffrage—but was always defeated by large majorities. In 1820 Lord John Russell moved against rotten boroughs, and also brought in motions on various phases of the subject in 1821-22-23-27-30, Lord Blandford filling up the gap in 1829. By 1830 the tide had turned, and the matter began to assume more serious proportions. The Tory ministry of the Duke of Wellington resigned in November of that year, and a reform ministry was formed by Earl Grey. Parliament reassembled on the 3rd of February, 1831, and on 1st March Lord John (afterwards Earl) Russell proposed the first Reform Bill. After a great debate the measure passed a second reading by a majority of one; but on the motion for a committee an amendment affirming that the number of representatives for England and Wales ought not to be diminished was carried against the government by a majority of eight. The bill was consequently abandoned, and Parliament dissolved. The new Parliament met again in June, and as the government had obtained a large majority in the election the second reading of the bill was carried by a majority of 136, and the third by 109. In the Lords, however, the first reading was defeated by a majority of forty-one, and Parliament was immediately prorogued. In the following year a fresh bill, which did not diminish the number of members, and which the opposition, therefore, considered a great improvement, was introduced, and the second reading carried in the Commons by a majority of 162, and the third by 116. In the Lords, too, the second reading was carried by a majority of nine; but in committee Lord Lyndhurst succeeded with an amendment against the government, "that the question of enfranchisement should precede that of disfranchisement," upon which the ministers resigned. A few days of most intense excitement followed, but the government were induced to resume office on the king giving them full power to secure majorities by the creation of new peers. When this fact became known many of the peers who opposed the measure absented themselves from the divisions, and the bill was ultimately read a third time by a majority of eighty-four—106 against twenty-two. It received the royal assent on 7th June, and was immediately followed by similar measures for Scotland and Ireland. The chief alterations made by this important measure were to totally disfranchise fifty-six boroughs, and reduce thirty to one member only; twenty-two new boroughs were created to send two members each, and twenty to send one member, besides additions to the county representation. The franchise was conferred on all persons in boroughs living in houses rated at £10 per annum and upwards, and in counties on all occupiers of £50 a year, the old 40s. freehold franchise remaining as before.

In 1854 Lord John Russell introduced a new Reform Bill, but was compelled to withdraw it in consequence of the Russian War; and the matter remained in abeyance, except as regards the attempts of private members (such as Mr. Locke King on the county franchise) to deal with the subject in a more or less fragmentary manner, until 1859, when Mr. Disraeli, as chancellor of the exchequer to Lord Derby's government, introduced the first Conservative Reform Bill. It proposed to lower the county franchise to £10, and also to introduce what were called "fancy" franchises, such as giving votes to persons who had taken literary degrees, and to depositors in savings banks; but it proposed no reduction in the borough franchise, and was defeated in the House of Commons by a majority of thirty-nine. A dissolution of Parliament followed, but the ministers were again defeated—this time the majority being thirteen; and a new government having been formed by Lord Palmerston and Lord Russell, another bill was intro-

duced in the following year by the latter statesman. It was, however, received with general apathy both by the House of Commons and the country, and was ultimately withdrawn; and although the government retained office till Lord Palmerston's death in 1865, they took no further action in the matter. The discussion of the subject was not, however, allowed to die out, for on two occasions Mr. Baines introduced a bill to lower the borough franchise, and Mr. Bright often spoke on the subject both in and out of Parliament. Lord Russell succeeded Lord Palmerston as prime minister, and on the opening of Parliament, in 1866, Mr. Gladstone, as leader of the House of Commons, introduced a government bill. At first it consisted only of a proposal to deal with the franchise by lowering it to a £7 rental in boroughs and £14 in counties; but as much opposition was manifested to this mode of proceeding, a scheme for the redistribution of seats was subsequently brought in, and both bills went into committee together. From the first the government was, however, feebly supported, and in many cases strongly opposed, by many lukewarm Liberals; and having been in only a very small majority on several points, they were at last defeated, by a majority of nine, on the comparatively small question of substituting the word "ratable" for "clear yearly value" with regard to the franchise. They immediately resigned and Lord Derby was again called upon to form a Conservative government. During the autumn immense meetings of the working classes were held in various parts of the country, at which the greatest order was observed (an unfortunate collision between the police and the populace certainly took place in consequence of an attempt being made to prevent the holding of a meeting in Hyde Park, London), and it became evident that the old argument as to the indifference of the people on the subject could no longer be justly used. On the opening of the session of 1867 Mr. Disraeli, the leader of the House of Commons, stated that the government had arrived at the conclusion that the question of reform ought no longer to be made one on which the fate of governments should depend, as all administrations had shown their inability to deal with it satisfactorily; and he therefore proposed to submit certain resolutions for the House to agree to or amend, after which the government would frame a measure in consonance with the wishes of the House. This plan, however, was strongly objected to, and withdrawn almost immediately. The government then introduced what is popularly known as the "Ten Minutes' Bill," from the fact that a member of the cabinet afterwards stated that it was agreed to in the last ten minutes of a sitting of the cabinet council, which proposed to reduce the borough franchise to £10 and the county to £20. This scheme met with little favour, and three of the leading members of the government, to whom any further reduction of the franchise was objectionable, having resigned, Mr. Disraeli introduced what he afterwards stated was his original idea—a measure to confer household suffrage in all boroughs. To the proposal was, however, annexed many of the previous Conservative "fancy franchises," but they were speedily got rid of in committee; and a lodger franchise having been added, the county franchise reduced to a £12 rental, and the plan for the redistribution of seats enlarged by allowing only one member to any borough of less than 10,000 inhabitants (the government had proposed 7000 as the limit), the bill was ultimately read a third time without a division. The House of Lords introduced several amendments, but only one was agreed to by the Commons—that known as the "minority clause," by which, in any constituency returning three members, a person is only allowed to vote for two. In the following year (1868) reform bills were carried for Scotland and Ireland. Seven additional members—obtained by totally disfranchising the seven smallest English boroughs—were given to the former country, and its fran-

chise was made the same as that of England, so far as local circumstances would permit. In Ireland no redistribution of seats was made, and the borough franchise was fixed at a £1 rental instead of household suffrage.

In 1872 the Ballot Act (first discussed in the Long Parliament, 1646) freed voters from any open undue influence. The great final step was taken, by the assimilation of the county to the borough franchise, in 1885 by Mr. Gladstone. All the former borough franchises were left untouched, the £10 clear annual value franchise, the household franchise, and the lodger franchise; and to them was added the "service franchise," a new franchise for those who inhabited a house as servants or caretakers. The £50 franchise in counties was abolished, and the £12 rateable yearly value reduced to £10 yearly value, and all the borough franchises were made applicable to the counties; thus raising the electorate of the United Kingdom from about 3,000,000 to about 5,000,000. A strong Redistribution Act accompanied this measure; no less than 160 seats were extinguished, and 96 of the places thus gained were given to the counties. London received 37 more members, and was cut up into many boroughs; other large towns also received suitable additions. The total number of members was raised from 658 to 670, England returning 465; Wales, 30; Scotland, 72; Ireland, 103. In all but a comparatively few cases the plan of single-member districts was adopted, even for the counties.

REFORMATION is the name generally given to the great schism in the Western Church, which took place in the first half of the sixteenth century. From a narrow standpoint it may be said to have commenced in 1517, when Luther affixed his theses to the door of Wittenberg church, and to have ended at the peace of Augsburg, in 1555, when the Church of Rome formally recognized the existence of Protestant States. But the re-awakening of the human intellect, of which this forms the most prominent period, commenced with the RENAISSANCE, and has gone on to our own day.

Dissatisfaction with the corruptions of the church had made themselves felt repeatedly during the thirteenth, fourteenth, and fifteenth centuries. Dante, the great poet of Catholicism, had placed popes in purgatory, and even in the deepest depths of the Inferno. Chaucer's "pardoner" and Boccaccio's "monks" were made to look contemptible in the eyes of all men. Innumerable reforming movements had arisen, most of which were crushed out in blood. The ALBIGENSES, the WALDENSES, the LEONISTS, and the LOLLARDS all alike suffered for conscience' sake. Zeal for reform was not confined to the laity. In 1409 the College of Cardinals called a council at Pisa, and in 1414 another council was convened at Constance. Reform of discipline and of doctrine did not, however, go hand in hand. The Council of Constance desired not only to reform the Church, but "to extirpate all heretical and erroneous doctrines," and in furtherance of this policy HUSS and JEROME OF PRAGUE were tried and executed, although the former had come to Constance under an imperial safe-conduct. The influence of Huss survived in Bohemia, and his followers, the Utraquists, obtained complete religious toleration in 1512. Our English WYCLIF, of whom Huss was a disciple, died in peace under the protection of John of Gaunt, duke of Lancaster; but in 1401 SAWTREY, the first Lollard martyr, was burned to death for refusing to worship the cross, and for denial of the doctrine of transubstantiation. The Humanist movement of ERASMUS and REUCHLIN had much to do with sapping the foundations of the old creed. By turning to the original Greek and Hebrew of the Bible, and by pointing out errors in the accepted Latin version, Erasmus fully deserved the charge made against him by the monks, of having laid the egg which Luther hatched, although he afterwards wrote against the Wittenberg reformer.

LUTHER, an Erfurt monk, is the most important figure of the Reformation. Deeply versed in the writings of St. Paul and St. Augustine, he had become imbued with the doctrine of justification by faith; and the glorification of works which Rome was then putting forward in a very practical form, excited his eloquent opposition. Pope Leo X., anxious to raise money for the building of St. Peter's, and also to carry on a little war on behalf of his nephew, had farmed out the sale of indulgences to the different potentates who cared to make money by the transaction. Albert, archbishop of Mainz, was his commissioner for Germany, and Albert employed a monk named Tetzel to visit Saxony. Luther denounced these indulgences from the Wittenberg pulpit and from his professorial chair, and set Germany, and indeed all Europe, in a blaze. The Pope issued a bull against him. Luther, amid the cheers of the crowd, burned the bull and a complete set of the canon-law books outside the city walls (1520). Burning the bull was a personal act of defiance, burning the papal decretals was a public declaration that Germany should not be subject to Roman jurisdiction. "I see no end of it," wrote the more cautious Erasmus, "but the turning upside down of the whole world." In 1521 a council was summoned at Worms, over which the young emperor, Charles V., presided. For many days the question of Luther's heresies was debated. The reformer had many friends among the princes and nobles at the Diet, who urged that he should not be condemned unheard. Finally he was summoned to Worms under a safe-conduct from the emperor. Men of different creeds will variously estimate Luther's earlier and subsequent conduct, but all must admire the courage with which, with the memory of Huss's fate in his mind, he made his way to the Diet, and the equally sublime manhood with which he faced the emperor and the papal emissaries. "Even had I known," he afterwards said, "that there would be as many devils at Worms as tiles upon the house-roofs, still I should joyfully have plunged in among them." "This man will never make me a heretic," said Charles, and he declared for Rome and allied himself closely with the Pope for the extirpation of heresy in his dominions. Luther was concealed for a time by his friend the Elector of Saxony, in his castle on the Wartburg. Here he translated the Bible into a homely German, the tongue of the common people, which he, a peasant's son, knew so well. "They steal my language from me," Luther complained, when an edition of his Bible was prepared for the Roman Catholic Church. Luther's Bible, and also his psalms and hymns, were more than all else the cause of the Reformation in Germany. In reading these latter one becomes convinced that Luther was no mere rough iconoclast, as the coarseness of much of his language would seem to indicate, but that behind his rough exterior there was infinite tenderness for the creed which he aspired to reform. The deepest devotion and spiritual enthusiasm shine forth in such lines as—

"Ein' feste Burg ist unser Gott,
Ein gutes Wehr und Waffen."

"A steadfast stronghold is our God,
A right good shield and weapon;"

or the Psalm—

"Aus tiefen Noth schrei ich zu Dir."

"Out of the depths have I cried unto Thee."

At the same time Luther often showed as much bigotry as those opposed to him. His pamphlet against the "murderous peasantry," who had risen in revolt against tyranny no longer endurable, cannot be justified even by the excesses of the peasants, or by the interruption which their struggles had caused to his religious movement. In this revolution 100,000 persons, most of them poor and wretched, are said to have perished. All the victims to the French Revolution put together might pass in such a mass

without great notice. Again, when ZWINGLI, whose cheerful temper knew nothing of the inward struggles which gave Luther so much power, held a controversy with him over the Sacrament, which the Swiss reformer treated as a symbol, the attitude of Luther was violent and dogmatic. Taking his stand on the literal interpretation of the text, "This is my body," he would listen to no word of compromise, and when the brave Swiss fell fighting at Cappel, in 1531, Luther exhorted Duke Albert of Prussia not to tolerate his followers in his dominions.

It is interesting to note that at the present day, while Luther remains the hero of Protestant Germany, the doctrines of Zwingli have most influence in that country. Mecklenburg-Schwerin, like Scandinavia, is firmly Lutheran, but Prussia on the other hand is mainly "United"—the church which compromised, and makes optional the sacramental test, which under Luther's influence so long separated the "Evangelical" or Lutheran from the "Reformed" or Zwinglian church. At the Diet of Spire, in 1529, the Catholic party passed a decree re-enacting the edict of Worms, and forbidding all further reform till a regular council was summoned. The Lutheran princes protested against this decree, and so earned the name of Protestants.

In 1530, at the Diet of Augsburg, Luther and MELANCTHON drew up the statement of Lutheran doctrines known as the AUGSBURG CONFESSION. At the Peace of Augsburg, in 1555, it was agreed that each state should adopt the religion of its ruler. When the prince was Catholic the people were to be Catholic, when the prince was Lutheran the people were to be Lutheran. The outcome of this treaty with its mock toleration—toleration for princes, but not for peoples—was the Thirty Years' War (1618-48), at the end of which, by the peace of Westphalia, true toleration was secured in Germany.

The Reformation in England was at first more political and personal than religious. Henry VIII., a zealous controversialist, commenced by writing a book against Luther, for which the Pope sent him the title of Defender of the Faith, and Luther called him a fool and the Pharaoh of England. So firm was his faith in papal supremacy that when Sir Thomas More, to whom he showed the manuscript, urged that he had put the case for the Pope too strongly, Henry reasoned with the knight, and succeeded in converting him to his view. Such is More's story; but the conversion cost him dear, for it was precisely for not repudiating this papal supremacy, when the king found it convenient to do so, that More was put to death. Repudiation soon became convenient. Henry wanted a male successor to his throne. A divorce from Catharine, his brother's widow and aunt of Charles V., was necessary before he could re-marry. The Pope refused this, and Henry determined to throw off the supremacy of Rome and have himself declared head of the English Church. At the same time his own opinions—anti-Romanist and anti-Lutheran—were made the standard of orthodoxy, and both churches furnished their martyrs during the remainder of his reign. The destruction of the monasteries, under the direction of Thomas CROMWELL, gratified the greed of the king and the anti-Romanist feelings of many of his subjects. Under Edward VI. Archbishop CROMMER changed the Liturgical Service; a reaction took place under Mary, but England was definitely committed to Protestantism under Elizabeth.

In the Netherlands a fierce and savage persecution by Spain led to a revolt alike spiritual and political, to the foundation of the Dutch Republic by William of Orange, and to the triumph of a toleration so complete that the United Netherlands were for a long time the chief asylum for the heretics of other lands. Sweden separated herself from Denmark, and, under Gustavus Vasa, carried out gradual reforms in the manner of England, only on a Lutheran basis. Her king, Gustavus Adolphus, became the chief Pro-

testant leader in the Thirty Years' War, and raised Sweden to a high position in Europe.

In Denmark (and Norway was under the same rule) the nobles joined the crown in crushing the power of the clergy, and Lutheranism became the prevailing religion.

All the Protestant nations, however, did not follow Luther as did Germany and Scandinavia. The Protestants of France, England, and Scotland accepted the guidance of JOHN CALVIN, of whom JOHN KNOX, the Scottish Reformer, and the COVENANTERS, were ardent disciples. Great intolerance and bigotry prevailed under Calvin's rule. Men were banished who mocked at him, and sent to prison for laughing at his sermons. For a slight doctrinal difference of opinion SERVETUS was burned. It is pleasant to turn from such fierce times to our own day, and recall an incident witnessed by the writer at the Luther Festival in Germany (1883). At the city of Erfurt, on Luther's birthday (St. Martin's Day), the children of the Sunday Schools, both Catholic and Protestant, went in procession to the town-hall, ringing little bells and singing in chorus a hymn written for the occasion, which asked God to bless and honour dear Martin in heaven; the Catholic children thinking only of the canonized saint, the Protestant children of Martin Luther!

Contemporary with the Protestant Reformation was the reform of the Roman Catholic Church itself. This great movement was (as Protestants think) unfortunately checked, but for a long time it seemed as if the Roman Catholic Church were about to embark on a career of progress, with results favourable to the maintenance of the unity of Christendom. Our own countryman, Cardinal Pole, was among the most ardent of the reformers—so much so that he laid himself under bitter suspicion of heresy at Rome; and before him Sir Thomas More and Erasmus had also heartily desired radical reforms. But when the Protestants split off, all such minds as More, Erasmus, and Pole declined to follow them and leave the ancient faith altogether, and eventually the Council of Trent on the one side imitated the hardness of Luther on the other, and made reunion altogether impossible.

The most scholarly books on the Reformation have been written in Germany—notably Leopold von Ranke's "German History." Translations of some of them, such as Gieseler's "Church History," and Hagenbach's "History of the Reformation in Germany and Switzerland," are included in Clark's Foreign Theological Library. Köstlin's "Life of Luther" is a valuable book from the Lutheran standpoint. Ranke's "History of the Popes," Roscoe's "Leo X.," Seebohm's "Era of the Protestant Revolution," and Beard's "Hibbert Lectures" will be read with interest. D'Aubigné's "History of the Reformation" is popular, but somewhat narrow in its sympathies. The brilliant works of Prescott and Motley throw important side lights on the question. The history of the Reformation in England has been written with fairness from the Roman Catholic standpoint by Lingard ("History of England"), and with more brilliancy, if less accuracy, from the Protestant standpoint by Froude ("History of England," 1530-88). But perhaps the most scholarly and impartial presentment of the Reformation history by an Englishman, based upon real research among authentic documents, is the fine work of the Rev. J. H. Blunt, the first volume of which appeared in 1869, and the second in 1882. The causes of the Marian reaction are now so admirably set forth as in the second volume; the characters of Gardiner and Bonner are properly rehabilitated, and the scandals of the lives of the chief Protestants are given their due weight; the real dimensions of the Marian persecution are almost for the first time brought home to the general reader, who learns, probably with astonishment, that only 277 persons in all perished. These were 277 too many, of course, but the popular idea is that

there was a stupendous slaughter. The religious executions under Henry VIII. and Elizabeth were, each of them, more numerous; but the length of their reigns must be taken into account. The head of the Marian persecution of Protestants is shown to be by no means the poor queen herself, nor Bonner, whose reluctance in the work brought official rebukes upon his head from the Privy Council, but the bigoted Philip II. of Spain, Mary's consort, and his Franciscan confessor, Alfonso a Castro. Mr. Blunt's book is quite indispensable for those who wish to know the lately discovered evidence on this thorny subject.

REFORMATORIES are schools to which magistrates may send juvenile offenders instead of to prison. They were legally established in 1854 by the Act 17 & 18 Vict. In 1866 an Act was passed to consolidate and amend previous statutes on the matter, and some minor amendments were introduced by the 35 and 36 Vict. c. 71, passed in 1872. In 1738 the Philanthropic Society founded a farm-school at Hackney for the reception of depraved and vagrant children. This institution is now, however, located at Red Hill, in Surrey, on a farm of 300 acres, where about 250 boys are continually being educated and trained for useful service. A reformatory school for girls was established in 1834 at Chiswick; and in 1852 Hardwick Reformatory, near Gloucester, was opened by Mr. Baker; Kingswood, near Bristol, by Miss Carpenter; Stoke Farm, Brousgrove, by Mr. Sturge; and Saltley, near Birmingham, by Mr. Adelerley. In legalizing these schools the government retained the voluntary agency, and encouraged its operations. The reformatories must be inspected and certified by a government officer before they are legally entitled to receive juvenile offenders. The act provides that on conviction, after a short imprisonment, generally not more than fourteen days, the child shall enter the school, and remain for the term of years named in the magistrates' sentence, under the sole management and control of its conductors, paid for by the Treasury at the present fixed rate of 6s. per week for the first three years, and after that period 4s. per week. Counties and boroughs may furnish from their funds money to aid in the establishment of reformatory schools. A youthful offender under the age of twelve years is not to be sent to a reformatory school unless he has been previously charged with some crime or offence punishable with penal servitude or imprisonment. In choosing a reformatory school, the court is to ascertain the religious persuasion to which the youthful offender belongs, when he may be attended by a minister of the same persuasion. The parent or guardian may apply to remove an inmate from one school to another, in accordance with his persuasion. The managers of a school may, after eighteen months' probation, by license, permit a youthful offender to live with any trustworthy and respectable person named in the license willing to receive and take charge of him. The license is not to extend beyond three months, and to be renewed until the detention has expired. Penalties are enforced for attempts to escape, and on persons assisting in an escape. The managers of a certified reformatory school may at any time after a lad has been placed out on license as aforesaid, if he has conducted himself well during his absence from the school, bind him, with his own consent, apprentice to any trade or calling or service, notwithstanding that his period of detention has not expired, and every such binding shall be valid and effectual. With regard to the expenses at reformatory schools, it is enacted that the conveyance of an offender and the cost of proper clothing for his admission are to be defrayed by the prison authorities within whose district he had been last imprisoned. While in school his parent, step-parent, or other person legally liable to maintain him, may be ordered, if of sufficient ability, to contribute a sum not exceeding 5s. per week. The order may be varied, and arrears may be enforced by distress warrant. The object of reformatories

is, of course, to rescue children from becoming confirmed criminals, and by a judicious course of training to enable them to make a fresh start in honest independent life. The results may be stated as being, upon an average, that about 70 per cent. (in some schools 90 per cent.) of those discharged are known to be doing well, and from 9 to 12 per cent. are reported "unknown," the remainder being doubtful cases or relapsed.

The total number of reformatories in the United Kingdom is about sixty. Industrial schools, which hold an intermediate position between voluntary ragged schools and reformatories, are described under **INDUSTRIAL SCHOOLS**.

REFRACTION OF LIGHT. If a ray, AO (fig. 7, Plate REFLECTION AND REFRACTION), falls upon a transparent surface of glass or other medium at O , a portion of the incident light will be reflected in accordance with the law of REFLECTION; but a portion of the light, the greater portion indeed, will enter the transparent medium and pursue the path represented by ON . The laws according to which this path is determined are called the laws of refraction. Draw the line ON normal to the refracting surface, and produce it into the interior of the surface at OM . The first law of refraction states that the incident ray, OA , the refracted ray, ON , and the normal, ON , are in the same plane. The second law states that the sine of the angle AOX , made by the incident ray with the normal, bears a constant ratio to the sine of the angle BOX . By constant ratio it is meant that in a given medium, and for different angles of incidence, the ratio of the sine of AOX to that of BOX is constant when light passes from a vacuum into the substance. But this ratio is different for different media, so that it becomes a characteristic of the medium, and is called the coefficient or *index of refraction*. Thus for water the coefficient of refraction is 1.336; for glass it varies under different circumstances, from 1.51 to 1.75.

The following table contains a list of the coefficients of refraction of various substances for the yellow rays of light:—

Diamond,	2.470000 to 2.750000
Topaz (colourless),	1.610000
Rock salt,	1.545000
Sugar,	1.535000
Crown Glass,	1.5250000 to 1.553400
Iceland spar,	1.654000
Ice,	1.310000
Sulphide of carbon,	1.678000
Linseed oil,	1.485000
Oil of turpentine,	1.470000
Alcohol,	1.372000
Sulphuric acid,	1.429000
White of egg,	1.351000
Water,	1.336000
Hydrogen,	1.000138
Oxygen,	1.000272
Ammonia,	1.000385
Chlorine,	1.000772

Let DA (fig. 8) be a ray which falls upon a polished spherical surface of glass. Draw the normal DAK to the glass at the point of incidence, then the ray DA , after falling on the glass, becomes bent towards the normal into the direction AF . The ratio of the sines of the angles DAK and EAF is the coefficient of refraction. If several parallel rays all fall on the same surface in the vicinity of C , then all these rays will, after refraction, proceed to the same focus, F .

Let ACB (fig. 9) be a wedge-shaped piece of glass or other transparent medium with flat and polished faces, forming what is known in optics as a prism. Let OP be a ray of light which falls on the prism at the point P , then the ray enters the prism, being bent towards the normal in its passage through the glass. On emerging from the prism

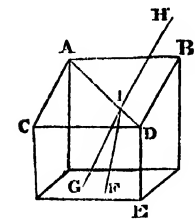
the reverse happens, and the ray pursues the path $q r$, which makes with the normal $m q$ a larger angle than the ray in the prism $r q$ made with the same normal. In each case the sine of the larger angle bears to the sine of the smaller angle the same ratio, which is, of course, the coefficient of refraction of the medium. The final effect is, therefore, that the ray which originally had the direction $o p$, now has the direction $q r$, so that the prism has bent the ray round towards its base. The amount of deflection depends upon the vertical angle of the prism, on its coefficient of refraction, and on the angle of incidence, $o p n$. For further details as to the refraction by a prism, see **SPECTROSCOPE**.

Let $r q$ (fig. 10) be a glass lens formed of two spherical surfaces, and let $A n$ be a ray of light falling upon that lens. After passing through the front surface the ray is refracted just as in the case of the prism, and on emergence moves in the line $n r$. It can be shown that when a whole beam of parallel rays fall upon a lens they will all, after refraction, pass through the same part, r , provided that the lens is formed of spherical surfaces, which are only small portions of the entire spheres. The distance from r to the lens is termed its *focal length*. For the application of lenses to optical instruments see **TELESCOPE** and **MICROSCOPE**.

Double Refraction.—Numerous crystallized or transparent substances exist, which either in their natural state or under accidental circumstances, exert a peculiar influence on light, causing it, as it passes through them, to divide into two rays, forming with each other an angle of greater or less amount. Such substances are called *doubly refracting substances*, and the phenomenon itself is known as *double refraction*. Precious stones, salts, most crystals, all animal and vegetable bodies (like mother-of-pearl) whose molecules are systematically arranged, glass and other transparent bodies when strained by heat, pressure, or rapid cooling, are *doubly refracting*. Through a plate of any such substance every object appears doubled.

Let $A B C D E$ be a crystal of carbonate of lime, whose faces have been made smooth by grinding, and place it on a sheet of white paper over a black seal or wafer, r ; then, on looking through the crystal, two wafers or seals become visible, one at r and the other at g .

Turn the crystal round on its axis, still keeping the same side on the paper, and one of the images, r , will remain invariable, while the other, g , will apparently describe a circle about it. If the object viewed be a straight instead of a round substance, then, on looking through the crystal, a double image of the line will be seen, one passing through r and the other through g . Turn the crystal as before, and you will note that the distance between the two straight substances varies, but that they always remain parallel to each other.



Also, while the crystal performs a complete revolution round its axis, there occur two positions in which the images coincide, and two other positions, midway between the former, in which they will attain a maximum distance. Hence we see that a ray of light, $h i$, on entering the face of the crystal, i , is separated by refraction into two pencils, $i r$ and $i g$; and it is found that on emerging from the crystals the two pencils make the same angle with the surface, and continue to follow a direction parallel to each other, and to the incident ray $h i$. As the ray $i r$ follows the laws of ordinary refraction, it is called the *ordinary pencil*; as the ray $i g$ obeys an entirely different law, it is called the *extraordinary pencil*.

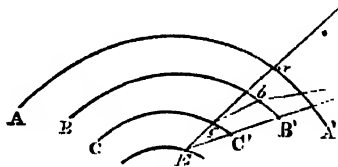
It has also been ascertained that, although a ray of light falling on the face of the crystal generally undergoes a double refraction, yet in one particular direction it

is subject only to the ordinary refraction. This direction is parallel to $A x$, the shorter axis of the crystal, and is called the *axis of double refraction*. Every line parallel to $A x$ forms this axis. In some crystals the extraordinary pencil is refracted *towards* the axis $A x$, in others *from* it. In the former instance the axis is called a *positive*, and in the latter a *negative* axis.

The property of double refraction was discovered by Bartholin in 1669, and was at first explained by Huyghens (in 1690) on the theory that light is propagated by an elastic medium. All those crystals whose primitive and simplest form has only one axis of figure, or one pre-eminent line about which the figure is symmetrical, have only one axis of double refraction. The property of possessing two axes of double refraction was only discovered in 1815 by Sir David Brewster.

Astronomical Refraction.—An apparent angular elevation of the celestial bodies above their true places is caused by the refraction of the rays of light while passing through the earth's atmosphere. It has been ascertained from experiment that the refractive property of a gas or aeriform substance is in proportion to its density. As the earth's atmosphere is not a medium of uniform density, but composed, as it were, of a succession of concentric spherical strata, each increasing in density, it is evident that a ray of light, as it enters each successive stratum, will undergo a slight divergence from its rectilinear course. The total of these deviations constitutes *astronomical refraction*.

Let $A A'$, $B B'$, $C C'$, represent the boundaries of the successive strata. Now, a ray of light starting from the star s would advance in a straight line from r to r' if deflected by no obstacle; but as it enters at $A A'$ a denser medium, it is refracted from a to b . At $B B'$ it enters a still denser medium, and diverges to c , and at $C C'$ deviates again to E . Instead of describing a straight line, therefore, it describes the polygon $s a b c E$, and to a spectator



at E , or the earth, the star will seem to be situated at c , in the direction of ec . The star accordingly appears elevated above its true place, and the difference between its true and apparent elevation, as represented by the angle $g E s$, is the astronomical correction for refraction. At the zenith there will be no refraction, which will increase in proportion to the tangent of the zenith distance. At 10° zenith distance the refraction amounts to $10'30''$; at 20° , to $21'60''$; at 40° , to $48'99''$; at 60° , to $100'85''$; at 80° , to $320'19''$.

Refraction of the atmosphere also produces considerable terrestrial effects on viewing distant bodies through media of different density. And as the density of the atmosphere varies with the elevation, it is clear that the *apparent place* of any object situated on a higher or lower level than the spectator, will be to a greater or less extent influenced by refraction. The rays of light, whether proceeding from a higher object, and passing, therefore, from a rarer into a denser medium; or whether proceeding from a lower object, and passing from a denser into a rarer medium, will equally incline downwards, and the *apparent* position of the object will necessarily be raised. This refraction between terrestrial objects is called *terrestrial refraction*. Now the density of the atmosphere near the earth is subject to great irregularities owing to irregular hot currents, and these

irregularities are the cause of some curious atmospherical phenomena, in which actual objects appear placed in the most fantastic and unreal positions. Of such is the *MIRAGE*.

Refraction of Heat.—When white light is broken up by refraction the spectrum contains heat-rays as well as light-rays through all its length, and the heat-rays are subject to any interference together with the light-rays. They can be reflected, refracted together, &c.; and in fact light-rays and heat-rays of the same refrangibility cannot be separated; what affects the one, speaking generally, affects the other. But the heat spectrum is far longer than the light spectrum; over half as long again for sunlight, and for the electric light fully double, in fact nearly treble; or rather, to be accurate, the visible part of the spectrum is not its whole, possibly from some peculiarity of the human eye. The invisible heat-rays can be sorted out (the solution of iodine in sulphate of carbon, for instance, is opaque to light-rays and transparent to the invisible rays beyond the red), and these heat or invisible rays can be refracted and reflected just as well as the visible ones; and with the help of a lens will inflame platinum foil or other substances when placed in the focus, and manifest themselves by the other usual tests. Heat-rays are, then (like light-rays, but with an extended range), variously refrangible, and the scale of refrangibility of heat has been happily designated by Melloni *thermo-chrose* (heat colour), from its close analogy to the coloured spectrum of light.

Refraction of Sound.—Not only the waves of light and heat, but also the analogous wave-systems of sound are capable of refraction. A sound-lens is easily formed of a small thin collodion balloon—a child's toy balloon will also do very well—filled with carbonic acid gas or any other gas heavier than air. If a going watch be placed on one side of the balloon, the ear will easily detect a spot on the other side, a few feet away, where the ticking sounds far louder than anywhere else, and if the ear is helped by a funnel or tube, serving the purpose of a *RESONATOR*, the effect is still more remarkably apparent. The spot is the focus of the sound-lens. To test the power of the lens let the ear be placed at the focus (the watch remaining unmoved), and let the balloon be now taken away; the ticks of the watch at once become quite feeble, or, if the focus be long, inaudible. The middle of the sound-wave is still retarded by the heavy medium in the balloon, while the ends of the wave, which have already passed through the edge of the lens, move faster in the free air, and therefore the edge of the sound-wave is made concave, and it converges to a focus. In the same way as light-shadows so also are sound-shadows thrown by obstacles.

REFRIGERANTS, as remedial agents, directly diminish the force of the circulation, and reduce the heat of the body or a portion of it, without occasioning any diminution of the ordinary sensibility or nervous energy. The agents which are usually regarded as refrigerants are weak vegetable acids, or very greatly diluted mineral acids; some saline, neutral, or super salts; and cool air, ice-cold water, and externally evaporating lotions. The application of ice in various diseases has been successfully adopted by Dr. Chapman, and in hydropathy refrigerants are necessarily employed to a considerable extent.

REFRIGERATING MECHANISM. An essential constituent of any machine hitherto used for producing cold continuously is an elastic fluid or vapour, which may be atmospheric air, ammoniacal gas, sulphurous acid gas, ether vapour, methylic ether vapour, &c. Such vapour is alternately compressed and expanded, during which certain phenomena manifest themselves, and a succession of such constitutes the working of a machine for producing cold. If the cycles be studied it will be found that they all involve introducing energy (in the form of heat, or its equivalent, mechanical work) into the cycle, and then rejecting it; by

this means the vapour is brought into that physically condensed condition by which it will absorb heat from an external substance by its own expansion or evaporation. A cold-producing machine abstracts heat from the substance being cooled by the spontaneous expansion or evaporation of an elastic fluid inside the machine, and to keep up a succession of such expansions and abstractions of heat from an outside body, heat or energy has to be given to the machine.

First, let us take the production of cold by atmospheric air. In this case we have four distinct stages in the cycle, the first of which is that air is compressed by mechanical force or work, which not only compresses the air, but makes it exceedingly hot, for according to the laws of thermodynamics 772 foot-pounds of energy used in compressing the air appears as a unit of heat in the compressed air itself. The second stage of the cycle is therefore to get rid of this heat actually put into the air, and this is done by injecting into the air well, river, or sea water, or by passing the compressed air through tubes surrounded with such water. This brings us to the third stage of the cycle, in which we have compressed air of atmospheric temperature. If we then make this compressed air work an engine constructed like a steam engine, it develops force and becomes immensely cold; and for every 772 foot-pounds of mechanical energy developed there is a reduction in temperature equivalent to one heat unit. We have now arrived at the fourth stage, which is, that the cold air is brought into contact with the substance we wish to cool, and goes back for another cycle. There is another way of producing cold by atmospheric air, known as the vacuum method, and it consists of three stages. In this case mechanical force is used to lift the piston of an air-pump, the energy here being rejected in the friction or heat of displacing the atmosphere. The rarefied air inside the pump is made to pick up heat from the substance being cooled, and being restored to its normal pressure is expelled. When ether is used the cycle is as follows: By mechanical work the ether vapour is pumped from the reservoir of ether and then passed in a compressed state through pipes surrounded with cold water; here the energy introduced by the pump is rejected in the form of heat, which is carried away in the cooling water; the liquid ether passes on into a reservoir, and then evaporates into the vacuum maintained by the pump; in fact the ether evaporates so rapidly in vacuo that it boils at a temperature approaching zero Fahr., and the liquid ether consequently abstracts heat from any substance we wish to be cooled by the machine. The cycle in the case of Pictet's sulphurous acid gas machine is precisely the same, only the whole apparatus is worked at higher pressure, owing to the boiling point of liquid sulphurous acid being lower.

Machines have also been introduced by Professor Lindé in which anhydrous ammonia is used instead of sulphurous acid gas; that is, ammonia gas absolutely free from water compressed by the mechanical force of a pump; the energy thus introduced is abstracted by passing the hot gas through pipes surrounded by water, and the liquid ammonia is then allowed to boil in vacuo created by the pump, which is at a temperature still further below zero than in the case of the sulphurous acid or ether, and thus abstracts heat from the brine or other liquid being cooled. The most common form, however, of the ammonia machine for producing cold is that introduced by Carré, and known as the ammonia absorption machine, and which has been much improved by Kece and others in this country. The cycle is very interesting to study. Ordinary very strong commercial liquid ammonia is put into a boiler of iron connected with an upright tower with shelves, a fire is placed under the boiler, and the mixed ammonia gas and steam ascend the tower; the steam condenses and drops back as water into the boiler, while the ammonia gas

goes out of the top of the tower, and then descends through a coil arranged in a second tower filled with cold water; this cold water, of course, condenses the ammonia gas inside the tubes, which by this time has got not only very hot, but very much compressed, there being a valve at the outlet of the coil which prevents the free flow of the gas, until by its accumulated pressure it liquefies itself. Comparing now this with the first two stages of the compressed air cycle, we have repetition of the same phenomena. We impart energy to the gaseous ammonia, we abstract it again in the water cooling the coil of pipe. The product, liquid anhydrous ammonia, then goes to the next stage, where it is allowed to evaporate or expand spontaneously by reduction of pressure.

This evaporation is usually accomplished in a vessel containing pipes through which brine or other liquid to be cooled circulates. We now arrive at the fourth stage of the process, in which we have simply ammonia gas at atmospheric pressure, and in order to complete the cycle we have to make this gas come into contact again with water, and so become absorbed, and this is done in a fourth vessel, in which heat is rejected, after which the re-formed ammonia solution goes back to the boiler from which it started.

Another class of cold-producing machine was devised by Mr. J. J. Coleman in the year 1876, and has been used on the large scale by Young's Paraffin Light and Mineral Oil Company for condensing volatile liquid hydrocarbons existing in the waste illuminating gas produced in distilling shale for oil. In this process energy was employed in compressing the hydrocarbon gases to a pressure of about 150 lbs. to the inch; this energy was rejected by passing the compressed gases through a system of tubes surrounded by cold water, a number of liquid hydrocarbons being thus obtained. The compressed gas was then passed through a second system of pipes, and then expanded in a cylinder, giving mechanical power to the crank-shaft working the machine; the cold expanded gas being made to circulate round the second system of pipes, gave a second crop of liquid hydrocarbons (the product of joint cold and pressure), and consisting chiefly of amylene and other olefines, after which the gas was burned as fuel.

Reverting to the definition with which we started—viz., that all cold-producing machines involve introducing energy in the form of heat or mechanical work, and then rejecting the same before the vapour is brought into that physical condition that it will expand spontaneously—we may extend the definition, and state that spontaneous expansion involves the abstraction of heat or energy from the substance being cooled, and transferring it (either as heat or mechanical work) to another body; and the extent to which this can be done in each cycle depends upon the energy introduced and then rejected in another part of the cycle.

The other machine was introduced twenty-five years ago, and has had a long run, but although ether is not so difficult to prepare for using in the machines as liquid sulphurous acid or anhydrous ammonia, it is inconvenient for use in hot climates on account of the lowness of its boiling point as compared with the heat of tropical countries.

Theoretically it is immaterial which chemical be employed, but the bulk of the machines, and the nature and cost of their construction, differ according to the substance selected. The substance most readily obtained under all circumstances is of course atmospheric air, and machines to use it have been successfully employed for some years in the transport of dead meat, &c.

The first machine constructed by the Bell-Coleman Mechanical Refrigeration Company of Glasgow, under the guidance of Mr. Coleman, was built in 1877. It was intended entirely for marine work, and to work between the

decks of a vessel where the vertical height does not exceed 6 feet 6 inches; it was also to be duplicated in all its parts, in fact a double engine on one sole plate, so that if one-half broke down the other could be worked by itself. This machine consisted of two steam cylinders, 10 inches in diameter and 18 inches length of stroke; two air-expansion cylinders, 14 inches diameter and 18 inches length of stroke; and four air-pumps of 14 inches diameter and 18 inches length of stroke—all connected by a four-throw crank-shaft, with four piston rods.

An amount of water equivalent to five times the weight of air taken in was partly injected by the water pump into the compressors, and partly in the form of a shower of rain into the air immediately after leaving the compressors, by which it was reduced to a temperature within 2 or 3 degrees of that of the water, the latter being drawn off by automatic traps or ballcocks. The air was then subjected to some of the cold air produced by the machine itself, by being made to traverse copper pipes arranged around the interior of the walls of the room of about 20,000 cubic feet capacity, being cooled. It was found that about 588 square feet of surface in the pipes caused a lowering of about 20 degrees in 20,000 cubic feet of air passed per hour. The moisture liquefied by this arrangement was removed by automatic traps, and was sufficient to prevent any inconvenient amount of snow being formed in the expanded air when the working pressure of the air was 30 lbs. per square inch above the atmosphere, the air being previously cooled by water to 65° Fahr. After this the air was expanded and delivered by means of wooden shoots to the various parts of the meat room. The temperature of the meat room was 35 degrees, the external air being about 70 degrees Fahr. A wet-and-dry-bulb hygrometer suspended in the room never indicated more than 70 per cent. humidity during the continuous working of this machine for two months. Several carcasses of beef were preserved in splendid condition, and fish became stiff and their wet skins externally quite dry by a day or two's exposure to the atmosphere of the room. It was found, however, that the ratio of the steam cylinder capacity to that of the compressors was not such as to allow of the machine being worked with steam of 40 lbs. without the assistance of a steam-condenser, a condition which was essential on ship-board, as the full boiler pressure and the use of the condenser of the main engines could only be obtained at sea, and the machine was required to work in port occasionally.

Steamers and sailing vessels fitted up with machinery on the lines laid down in 1878 are now to be found regularly traversing the Atlantic and Pacific, and frequenting the ports of London, Glasgow, Melbourne, Sydney, Canterbury, Otago, Batavia, Calcutta, New York, Bermuda, and crossing the Red Sea, the Indian Ocean, and the Mediterranean. Their aggregate cooling power is such that they could without difficulty freeze 400,000 tons per annum, and, if worked at full power and speed, their steam cylinders would indicate full 8000 horse-power. Their work is various. They have brought frozen salmon from the shores of the Labrador and delivered it in London; they have kept it in the frozen state in London for six months while being sold in instalments; they have again transferred it to the shores of Australia. They have conveyed a great number of tons of English fish by means of the Orient steamers to the same colonies, comprising soles, turbot, whiting, &c., which have been bought up and eaten by our Australian cousins, curious to taste and eager to pay several shillings a pound for such dainties. Their chief duty has, however, been in bringing meat to Great Britain, upwards of 400 cargoes having arrived at our ports, of the money value of over £8,000,000 sterling.

Figs. 1-8, Plate, represent machines as now constructed for cooling ships' provisions and making ice. The air is compressed in the air-pump, r, deprived of its heat by

compression in the tower, r, passes through the horizontal moisture-depositing pipes packed in the sole-plate, and is finally expanded in the act of doing work in the cylinder, r, from whence it is conveyed round the outside of the metallic cells containing the water required to be frozen for table use, and then is delivered into the chamber containing the meat and provisions. The length of this machine is 12 feet, its breadth at the point r is 3 feet, and at the point k is 4 feet, and its height is such that it will go in 'tween decks of any vessel. Its best position is adjoining the main engine room, but as the stewards' departments are frequently elsewhere, the machine is sometimes placed on the upper deck, or in the position usually occupied by the old ice house. The air delivered by these machines is so dry as well as cold, that calico or paper hung up in it ignites readily on application of a flame, so that the provisions are prevented from getting into the slimy condition which they assume when packed in ice. The provision-room of a large steamship measures internally perhaps 2000 cubic feet, including the space necessary for storing the wines, salt meat tanks, &c. The air-pump in this new machine is placed in the position of a steam cylinder, fig. 1, and the gas motor cylinder takes the place of the air-pump, r, on same diagram. Such machines, affording a cooling power equal to what could be obtained by the use of half a ton or a ton of ice per day, are now being made for retail shops, country mansions, &c.

Fig. 4 is a section of one of Messrs. Shaw, Savill and Albion Company's ships fitted up, the end view of the engine appearing in top left-hand corner, and the space cooled being not only the 'tween decks, but the lower hold of the forward half of the vessel.

In the case of the steamships of the Orient Line and other steamers the cold chambers for containing the meat have been constructed in the 'tween decks of the ship, so that their form varies; but the method of building them consists of lining the walls, the floor, and the roof of the meat-chamber with woodwork containing hollow spaces filled with wood-charcoal or shavings. It is found that 7 inches thick of such lining forms very fair insulation; but, in the case of tropical ships, it is frequently made 10 or 12 inches thick. It is also found that the larger the quantity of meat brought over the more economically can the work be done. Thus the prime cost of the machinery for carrying a pound of meat is 25 per cent. less when a ship is fitted up to carry 1000 tons instead of 500 tons, and there is a further gain of 10 per cent. in the less packing space required. The air discharged from the machines is generally 80 degrees below zero Fahr., and oftentimes 100 degrees.

REFUGE, CITIES OF, were very common among the nations of antiquity, especially the Hebrews, Greeks, and Romans. They were intended for the security of those who were unintentionally guilty of manslaughter. In the Old Testament there are some minute descriptions of them. Moses appointed six cities for the culprit to retire to and be protected from the fury of the deceased's relatives until he had time to prepare for his defence. We are informed by Maimonides that not only these six cities were assigned, but also the forty-eight cities which were appointed for the habitation of the priests and Levites; with this difference, that in those established by law the refuge was supported at the public expense. The practice of sanctuary, as it existed among the early Christians, was doubtless borrowed from the above custom. It was so strictly observed under the Eastern emperors that Gratian, Valentinian, and Theodosius the Great decreed that those who should go into a church, or other sacred place, and force away any person who had taken sanctuary there, should be condemned to banishment, whipping, &c.; and Honorius commanded that they should be punished as if guilty of treason.

REFUGE, HARBOURS OF, are roadsteads of good depth, protected by breakwaters, and accessible at all tides, where ships may take refuge during storms. They are sometimes combined with commercial harbours, as at Cherbourg, where there is a capacious protected roadstead outside of the harbour proper. Harbours of refuge are formed entirely at the national expense. See HARBOUR, and DOCK.

REGAL or **REGALS**, the name of a small portable organ of mediæval times. The pipes are all (beating) "reeds." The cases of regals are often of very beautiful shape. In general they had keys like the organ; but in the regal which is shown on Plate II. ORGAN, and which is copied from a fifteenth-century painting in the National Gallery by Melozzo da Forlì, the keys take the shape of small pistons. Regals sometimes had more than one set of pipes, and were then not held in the arms as in our illustration, but placed upon a table; also, the bellows, instead of being blown by the performer, was blown by an assistant.

In a very fine specimen of this kind shown (and which was also played upon) in the International Music Exhibition of 1885, there were two simple bellows, carrying weights, and the assistant raised the lid first of one and then of the other, standing at the back of the table, opposite to the performer. The tone was sweet and effective, but of course the bass was very deficient.

Regals or *Rigols* was also the name given to a sort of wood harmonicon, a series of slabs of tuned wood struck with a stick, still in use under the latter name (*rigols*) at the close of the last century.

REGALIA, the ensigns of royalty. This term is more especially used for the several parts of the apparatus of a coronation. In England, the regalia properly so called are St. Edward's crown, made for the coronation of Charles II., to replace the one broken up and sold during the Civil War, the new state crown made for the coronation of Queen Victoria, the Prince of Wales' crown, the queen's diadem or circlet of gold made for the coronation of Marie d'Este, consort of James II., the Koh-i-Noor diamond, the sceptre royal, the verge or rod with the dove, the staff of Edward the Confessor, the orb or mound, the sword of mercy, called Curtana, the two swords of spiritual and temporal justice, the ring of alliance with the kingdom, the armilla or bracelets, the spurs of chivalry, and sundry royal vestments. The regalia here enumerated, all but the vestments, are preserved in the Jewel-office in the Tower of London. The Scotch regalia are kept in the Crown Room of Edinburgh Castle, and consist of the crown, sceptre, sword of state, and various decorations worn by different Scottish sovereigns.

REGATTAS are meetings held, generally in summer or autumn, for the purpose of testing the swiftness and seaworthiness of sailing and rowing boats, and the skill, tact, and endurance of their crews. They are specially intended for the amusement and instruction of those interested in nautical pursuits, but they are also well fitted to afford pleasure and excitement to the general public. Probably the first sailing match for pleasure-boats that took place in England is that recorded by Evelyn in his Diary, dated 1st October, 1661. It was between the two highest personages in the realm, Charles II. and his brother the Duke of York. There are now about thirty yacht clubs in Great Britain and Ireland—most of which give annual regattas—besides a great number of clubs for the promotion of rowing, many of which also hold annual meetings, and give handsome prizes to be competed for. The sailing course, where that is practicable, is generally marked out of a square shape, which is best calculated to bring out the different points of sailing of the contending yachts. Flag-boats are placed at the corners of the square, round which the competing vessels sail once, twice, or

thrice, according to the length of the course and the size of the yachts. There are three different methods of starting the yachts at these regattas:—First, from moorings with furled sails; second, from moorings with after sails only set; and third, from under-way. According to the first plan, all the canvas has to be set at once when the starting gun fires, which is a severe strain upon the crew of a first-class cutter or schooner, owing to the great weight of the heavy racing mainsails which have to be run up at railway speed, while the jib and fore sail have to be set at the same time, and the gull-topsail immediately afterwards. The second method of starting is that which is most generally adopted. The contending yachts draw lots for places, and the yacht which is fortunate enough to obtain the weathermost station gains a considerable advantage at the start. The third mode—that of starting yachts from under-way—is managed as follows:—The competing vessels are hove to at a short distance from the flag-ship, abreast of which a flag-boat is moored. A gun is then fired for each yacht to start according to the number of the station she has drawn. If she passes between the flag-ship and the boat moored abreast of it within one minute, or whatever other time may be fixed, after the gun has been fired on board the former, that time is allowed her on coming in; if she does not, the time is added. This mode of starting is only adopted at those places where the depth of the water makes it difficult and expensive to lay down starting-moorings.

On many of the rivers, lakes, and canals of the United Kingdom rowing matches are a favourite and popular amusement; but undoubtedly the two principal regattas are those held at Henley-on-Thames, where the amateur oarsmen of Great Britain annually assemble, and where the chief rowing clubs on the Thames and the best rowers of Oxford and Cambridge meet in friendly contest; and the annual eight-oared race between the rival crews of the two universities, where the excitement and interest are only surpassed by the Derby day.

REGELATION. This property of ice, discovered by Faraday, and named by him regelation, is the power to reunite two surfaces of ice, by freezing, into one, if pressed hard together at their points of contact. This curious phenomenon has given rise to much controversy, but Faraday's explanation still appears the best one. He pointed out that the particles on the exterior of a lump of ice are held by cohesion on one side only, and are therefore free to pass into water, or the vapour of water, on their free surface, hence all ice is wet at ordinary temperature. Not so the inner parts of the ice, where cohesion will hold the solid particles together, even at melting point (or freezing point, in this case the same thing). If two ice-surfaces, each by hypothesis being moist, be placed together and firmly pressed, the attraction of cohesion, in Faraday's view, is able to act through the watery film, and the particles of water return to the solid state; they freeze anew, or *regele*, and the whole becomes one mass.

It is by regelation that the formation of a snowball becomes possible, and it is by this also that (as Professor Tyndall considers) glaciers are able to traverse hilly and broken ground; the ice not flowing, as was once thought, but cracking and refreezing alternately.

REGENSBURG. See Ratisbon.

REGENT, REGENCY. These words, like *rex*, contain the same element as *rego*, to rule; *regens*, ruling; and denote the person who exercises the power of a king without being king, and the office of such a person, or the period of time during which he possesses the power. Wherever there has been an hereditary kingly office, it has been found necessary sometimes to appoint a regent. The cases are chiefly those of (1) the crown devolving on a minor; (2) mental incapacity of the person in whom the kingly office is invested; (3) temporary illness, and in-

capacity in consequence; (4) absence from the realm. In the first case the regent has usually been called in England by the name of Protector; the latest instance was the minority of Edward VI., when his uncle, the Duke of Somerset, was the protector.

The occasional absences of George I. and George II. on visits to their continental dominions rendered the appointment of regents a matter of convenience, if not of necessity. Sometimes the power was put, so to speak, in commission, being held by several persons jointly; but Queen Caroline occasionally discharged the functions of regent during the absence of George II.

When George III. was incapacitated for performing the duties of royalty by becoming insane, a question arose whether the heir apparent, being of full age and the king's eldest son, did not of right become regent. The Whig party of the time, led by Mr. Fox, contended that he did. On the other side it was maintained that it lay with Parliament to nominate the person who should be regent. The king having recovered, no one was at that time appointed. When, however, the king was a second time incapacitated, the title and office of regent were conferred on the Prince of Wales. But it was done by Parliament, who laid certain restrictions upon him during the first year. In the event (which event did happen) of the continued incapacity of the king, he was to enter into the full possession of all the powers of king—hearing, however, only the name of regent.

REGENT D'ORLÉANS, governor of France during the notorious period called the *Regency*, lasting during the minority of Louis XV., from the death of Louis XIV. (1715) to within a few months of the death of the Due d'Orléans himself in 1723. See ORLÉANS.

REGGIO DI CALABRIA (*Rhegium*), the most southerly city and seaport of Italy, the capital of a province of the same name, situated on the east side of the Straits of Messina. It is 8 miles distant from the town of Messina, and is one of the oldest towns of Italy. It was founded nearly 700 years B.C., by a party of Chalcidians, Zancleans, and other Greek colonists, and was for 200 years the capital of one of the principal republics of South Italy. It was very celebrated for its wines, and was the birthplace of Agathoklès, and of the philosophers Hippias and Hipparchos. Under the Romans it was one of the few Greek cities which preserved their language and customs. It was taken by the Normans in the eleventh century, and was a part of the Kingdom of the Two Sicilies from that time to 1860, when it capitulated to the troops of Garibaldi. Near it is the mountain of Aspromonte, where he was wounded in 1862. The town has several times suffered from earthquakes, and was completely destroyed by the great earthquake of 1788. The present town therefore presents a modern appearance, with its broad and handsome streets extending from the sea to the beautiful hills in the rear, which are studded with numerous and handsome villas. It is the see of an archbishop, is walled and well built, with wide and spacious streets. Among the public buildings are the cathedral, numerous churches and convents, a royal college, hospitals, &c. The manufactures consist principally of silk, cloth, hosiery, essences, thread from the fibres of a large *pinna*; there is a considerable trade in wine, olive oil, fruits, and the other produce of the fertile country eastwards. Indeed the city is the great nursery of orange and lemon plants for all parts of the kingdom. The Bay of Reggio is remarkable for the optical phenomenon called *Fata Morgana*. The population in 1861 was 23,583, or including the suburbs 39,296.

REGGIO NELL' EMILIA, a town of North Italy, the capital of a province of the same name, situated 15 miles W.N.W. of Modena, in a beautiful country on the Molini Canal, near the Crostolo. It is a bishop's see, and

is defended by a wall and ruinous citadel. It is built with arched streets and elegant houses, and has a fine cathedral and other churches, a town-house, a theatre, a public library, containing the works of Spallanzani, a museum of antiquities, manufactures of silk and woollen cloth, and of articles in horn, wood, and ivory, a trade in cattle and wine, and a large annual fair. The famous theatre stands in the large Piazza del Foro Boario. The population in 1881 was 50,651. *Rhegium Lepidi* is supposed to have been founded by M. Æmilius Lepidus, who constructed the famous Æmilian Way. It was here that the elder Brutus was slain by order of Pompey. Napoleon erected Reggio into a dukedom for Marshal Oudinot. Among other distinguished individuals to whom this town has given birth, may be mentioned Ariosto, one of the greatest of Italian poets, born here on the 8th of September, 1474; and the naturalist Spallanzani; its vicinity has also to boast of being the birthplace of the great painter, Antonio Allegri, surnamed Correggio.

REGIL'US, LAKE, a lake in Tusculum, near Gabii, not now identified with any accuracy, but very famous in ancient times on account of the victory which, by giving Rome the hegemony over Latium, laid the principal foundation of its future empire (B.C. 498). The whole territory round Rome is highly volcanic, and the disappearance of a small lake is no great wonder. Many geographers consider that the valley of Isidoro may represent the dried-up bed of the lake.

REGIMENT, a body of troops, whether infantry or cavalry, forming the third subdivision of an army. The union of two or more regiments or battalions constitutes a brigade, and two or more brigades make up a grand division, or corps d'armée. A regiment is commanded by a colonel, a lieutenant-colonel, and a major; and if it is divided into two or more battalions, each of these has, at least when complete, its own lieutenant-colonel and major. The real command rests with the lieutenant-colonel in each battalion, who has for a staff an adjutant, a quartermaster, a paymaster, and a surgeon. A cavalry regiment is divided into eight troops. The artillery force is now comprised in one regiment, called the Royal Regiment of Artillery; and the engineers in one body, called the Corps of Royal Engineers. The cavalry consists of thirty-one regiments, including Life Guards, Horse Guards, Dragoons, Hussars, and Lancers, the infantry of seventy-one regiments, including Foot Guards, Rifle Brigade, Royal Fusiliers, Royal Highlanders, Royal Scots, Royal Scots Fusiliers, Scotch Rifles, and the rest of the territorial regiments of the line. Each regiment of foot consists of two regular and of one, two, or more militia battalions, the number of men in each battalion being not fixed, but capable of being increased or diminished according to circumstances and as the army is on a peace or a war footing. The present regimental system was settled by Act of Parliament in 1881.

REG'ISTER, a name given to the chief divisions of the voices of singers, as chest-register, head-register, &c.; sometimes to classes of voices, as soprano, alto, tenor, bass, &c., for which see VOICE or SINGING; also a name given to the draw-stops of organs, for which see ORGAN.

REG'ISTER, REGISTRATION, REGISTRY. The mere possession of land is not sufficient evidence of the title to it, except in those cases where it can be shown that it has been held by a party who offers to sell it for such a period as to preclude, under the operation of the Statute of Limitations, all claims by any other party. In tracing the title to land, a purchaser or mortgagee requires to have the right established by the production of the instruments under which the title to it is derived: and the legal period during which such title can be required to be shown is the last sixty years. This production of the evidence of title is, however, expensive, and does not always give perfect security.

The Real Property Commissioners devoted their second report to the subject of a general register of deeds, and they unanimously recommended the establishment of a general public register for England and Wales of all deeds or instruments affecting land, in order to secure titles against the loss or destruction, or the fraudulent suppression or accidental non-production of instruments; to simplify titles by rendering in most cases needless the assignment of outstanding terms; to protect them from the consequences of constructive notice; and to render conveyances shorter and more simple.

In 1862 the Land Transfer Act was passed, under which a system of registration of titles was established; but it proved a failure owing to the strictness of the law. In registering a title as indefeasible the registrar was directed to require a good marketable title, such as the Court of Chancery would compel an unwilling purchaser to accept under a contract of sale. Now, there is often some difficulty or question, practically unimportant to a holder, but making the title not absolutely clear, requiring (in case of sale) to be met by restrictive conditions of sale, which after explanation by the solicitors are found not to affect the biddings materially. A purchaser who was advised that he might safely disregard such a defect found that an entry of it would be made upon the register if he registered. In practice the average of titles accepted by purchasers do not extend further back than thirty years; but a purchaser who obtained even a forty years' title found, if he availed himself of this statute, that the registrar had to put him to the expense of showing a sixty years' title. A Royal Commission was appointed in 1869 to investigate the matter, and in their report, issued in 1870, they recommended that a system should be established analogous to that of the registries of stock. Only those who represented absolute ownership should be placed on the register, and all partial interests should be kept off the register, and protected only by a system of cautions or stops. Their recommendations have not been carried into effect, but the 38 & 39 Vict. c. 87 was passed in 1875 with the view of simplifying titles and facilitating the transfer of land. Any person may apply at the Land Registry Office in London to be registered under the Act as to freehold land, provided that in the case of land contended to be bought the vendor consents to the application. A separate register is kept for leasehold land. A person claiming an interest in any land not on the register may lodge a caution with the registrar that he is entitled to notice, and the cautioner is liable to damages for an improper application. District registries may also be created under the Act.

REGISTRATION OF BIRTHS, DEATHS, AND MARRIAGES.

Parish registers were not kept in England till after the dissolution of the monasteries. The twelfth article of the injunctions issued by Thos. Cromwell, Henry VIII.'s secretary, in 1538, directs that every clergyman shall, for every church, keep a book wherein he shall register weekly every marriage, christening, and death, any neglect being made penal. In the first year of the reign of Edward VI. (1547) ecclesiastical visitors were sent through the different dioceses in order to enforce various injunctions, and among others that of Cromwell with respect to parish registers. In the beginning of Elizabeth's reign this injunction was repeated, when the clergy were required to make a protestation in which, among other things, they promised to keep the register-book in a proper and regular manner. In 1694 an Act for a general registration of marriages, births, and deaths was passed merely for purposes of revenue; it is entitled "An Act for granting to his Majesty certain Rates and Duties upon Marriages, Births, and Burials, and upon Bachelors and Widowers, for the term of five years, for carrying on the war against France with vigour." The 52 Geo. III. c.

146 (1812), made some alteration in the law, chiefly with reference to having the books made of parchment or strong paper, and to their being kept in dry and well-painted iron chests.

The Registration Act (6 & 7 Will. IV. c. 86; 17th August, 1836), entitled "An Act for registering Births, Deaths, and Marriages, in England," came into operation on 1st July, 1837, and provided for the establishment of a general registry office in London, at Somerset House. Register offices were also provided in each union by the guardians, under the care of a superintendent registrar. Registers were to be provided by the registrar-general, for making entries of all births, deaths, and marriages of her Majesty's subjects in England and Wales, according to prescribed forms.

When this Act was passed, however, the government of the day lacked the courage to push to its logical conclusion the principle involved in the measure, and the consequence was that the law of registration, while made in a secondary degree obligatory, was primarily and essentially permissive only. A parent, for example, was bound to give the particulars required for the registration of his child's birth if the registrar applied to him for them, but unless such application were made he might please himself about registering the birth. The effectiveness of the registration system, as regards births, was thus left dependent upon the option of parents, and the means taken by the registrars to "inform themselves" of the occurrence of births—the latter condition being naturally difficult of fulfilment in large and densely populated sub-districts, and it is known that a very large number of births were not registered at all. The registration of deaths being (as in the case of births) compulsory only in event of application by the registrar for particulars, no doubt many deaths would have escaped registration had it not been enacted that for burial purposes a registrar's certificate or a coroner's order must be produced to the officiating minister, who was required under a penalty to give notice to the registrar whenever the certificate or order was not forthcoming at the funeral. A means of information of the occurrence of death was thus opened to the registrar which was wanting in respect of births, and hence the incompleteness of the birth as compared with the death registration system. The registrar-general's department became aware that it was working under difficulties owing to the hybrid character of the registration laws, and when, in 1854, a Registration Act was passed for Scotland, the experience of the English office was taken advantage of and the law was made compulsory north of the Tweed. An Act similar to that for Scotland was passed for Ireland in 1863, but it was not until 1st of January, 1875, that compulsion became law in England, under the provisions of the 37 & 38 Vict. c. 88, passed in the previous year. Qualified informants of births and deaths—in the case of births the duty rests primarily on the parents, but to meet exceptional cases the occupier of the house or any person present at the birth can give the information—are now under legal obligation to give personal information of those events within stated times. By "giving information" is in all cases meant personally communicating to the registrar such full particulars of the birth or death as may enable him to register, and signing the register in his presence. No fee is charged unless the informant prefers the attendance of the registrar at his house, in which case 1s. is payable. In such cases a written request must be sent to the registrar to attend. All births must be registered within forty-two days, or a penalty of 40s. is incurred. Registration of a birth may be effected afterwards, but only under restrictions involving some trouble to informants and on payment of fees. Deaths must be registered within five days, or a similar penalty to that of non-registration of births is incurred. No burial can take place without

the registrar's certificate. A valuable restriction is imposed by the Act in relation to the burial of still-born children. No still-born child can now be buried without the production of a certificate or declaration of still-birth. This provision, designed to prevent the burial of still-born children who have lived, is enforced by a penalty on persons burying of £10. See BIRTHS, REGISTRATION OF.

In the case of marriages, in the Church of England the clergyman acts as a registrar, and is bound to send a copy of the register to the superintendent registrar of the district; while other marriages (as in Nonconformist chapels or in the superintendent registrar's office) are only valid when the necessary legal formalities have been gone through in the presence of the superintendent registrar or of a registrar. [See MARRIAGE.] Copies of the registers are kept in Somerset House. They may be searched over any period not exceeding five years, on payment of a fee on 1s. If a certified copy of any entry is required, the fee (including a stamp-duty of one penny) is 3s. 7d.

REGISTRATION, PARLIAMENTARY. In the case of occupiers of land or houses, shops, warehouses, &c., under the £10 franchise, and of occupiers of dwelling-houses under the household franchise, it is the duty of the overseers in every parish to include them in the list of persons entitled to vote made out by them annually, and which is posted on the doors of the churches and chapels and other public places in the parish on the 1st of August. The overseers ought to have upon their rate-books the name of every occupier of a rateable hereditament in their parish, and if it can be proved that either wilfully or negligently, they have omitted anyone's name, they are liable to a penalty of 40s. for every offence. It is their duty to do this even when the rate is collected from the landlord instead of the tenant. If they did their duty perfectly every person who occupies a shop, or warehouse, or dwelling-house, or even those who occupy parts of houses as dwelling-houses (where the landlord is non-resident), would have their names inserted in the occupiers' column, so that when the overseers made out their list of persons entitled to vote, all who had occupied qualifying premises for the requisite time would be included in that list. As a matter of fact, however, there are always a large number of omissions and inaccuracies, and all persons entitled to be included in the overseers' list, but who have been omitted, should send a claim to be registered to the overseers before the 20th of August. In September or October these claims, and the overseers' list, are submitted to the revising barrister, by whom objections are decided on, and the final list is then printed, and remains in operation for twelve months, from the 1st of the following January.

To be on the householders' list a person must have occupied a dwelling-house in the borough or county division for twelve months previous to the 15th of July, and must have paid before the 20th of July all rates and taxes due before the 5th of January previous. The dwelling-house may be a separate house, a room or rooms in a house in which the landlord to whom the rent is paid does not live, or, under what is called the "service franchise," a separate furnished bedroom in an employer's house, if the employer himself does not live on the premises. Occupation without residence also entitles an occupier to a vote in borough or county on two conditions. The first of these conditions is, that the premises must be of the clear yearly value of £10; and the second condition, that if the premises are in a Parliamentary borough the occupier must have resided for six months previous to the 15th July, either in the borough or within 7 miles of its boundary. If the qualifying premises are in the city of London the limit of residence is 25 miles; if the premises are in a county division there is no limit at all. It may be as well to add that in cases where a householder has, within the twelve months, moved to

another house in the same borough he must send in a claim setting out what the change of residence has been.

The lodger franchise is governed by wholly different rules from those which regulate the household qualification. The "property qualification," which has been abolished for the householder, is retained for the lodger. No lodger, moreover, can enjoy the parliamentary franchise either in boroughs or counties without claiming it every year, and his claim must be sent in on or before 25th July, but new lodger claims need not be sent in till 20th August. To be entitled to a lodger vote a man must rent lodgings which, without furniture, would be of the annual value of £10 or upwards. Unfurnished lodgings at 4s. a week will thus entitle the lodger to a vote; if the lodgings are let furnished it is generally held that 5s. a week is sufficient to qualify, the extra 1s. paying the rent for the furniture. The lodgings must have been occupied for the whole of the twelve months ending on the 15th of July. If the lodger has, during the twelve months, moved across the street or into the next house, he is disqualified. If he has moved into different rooms under the same roof he may retain his vote on condition of stating in his claim what the change of rooms has been. If two persons occupy the same lodgings they may both claim a vote if the rent paid is sufficient to make two £10 qualifications, and if they have jointly taken the lodgings and are jointly responsible for the rent. It is not necessary for the lodger to sleep continuously at his lodging, so long as he continues tenant with the power to return, and does sleep there when he chooses.

REGIUM DONUM. See IRELAND.

REGNIER, MATHURIN, a French satirist, born at Chartres in 1573; died in 1613. He was a nephew of the poet Desportes, and receiving the tonsure at the age of nine, he accompanied the Cardinal de Joyeuse to Rome in 1593, and the Duc de Bethune in 1602. On his return in the latter year he became a canon of Chartres, and received a pension of 2000 livres. Abandoned to all sorts of dissipation, he died at the early age of forty. Regnier was the first French writer of prime importance as a satirist; and his work in this respect is so excellent as to bid fair to be immortal. Unfortunately there is but very little of it. There are only thirteen satires in all. They appeared in 1608. The best editions of his works are those of "Viollet le Duc" (1821) and of Lequien (1822) with the commentary of Brossette.

REGULAR FIGURES AND SOLIDS (*Polygons and Polyhedrons*). A regular polygon, meaning one of which all the sides are equal, and all the angles are equal, may have any number of sides from three upwards. Those of three and of four sides respectively are called equilateral triangle and the square. The Greek terms pentagon, hexagon, heptagon, octagon, nonagon, decagon, undecagon, dodecagon are in use to express polygons of five, six, &c., up to twelve sides. The term quidecagon is in use to express the polygon of fifteen sides. The regular polyhedrons are five in number—the tetrahedron, octahedron, icosahedron, bounded respectively by four, eight, and twenty equilateral triangles; the hexahedron, or cube, bounded by six squares; and the dodecahedron, bounded by twelve regular pentagons.

REG'ULUS, MAR'CUS ATIL'IUS, a Roman hero, was sent as consul in the Second Punic War, 256 B.C., to invade Africa. He gained several brilliant victories, took the city of Tunis, and menaced Carthage itself. The Carthaginians, driven to despair, gave him battle once more, and gained a complete victory, 255 B.C. After a captivity of five years, Regulus was sent to Rome as a prisoner to offer terms of peace from Carthage, on his promise to return if the treaty was not concluded. The Romans, mainly guided by his advice, rejected the Carthaginian proposals; and Regulus, well knowing the fate that

awaited him, heroically kept his promise and returned to Carthage, where his enemies, exasperated at their disappointment, put him to death with cruel tortures.

This favourite story of Regulus has been much doubted in modern times. It was pronounced a mere fiction by Niebuhr, and Mommsen, the latest and most authoritative Roman historian, after a most rigorous examination, pronounces that nothing further is really known of the end of Regulus than that he died in Africa. He finds little authority for the mission of Regulus to Rome, and quite coincides with Niebuhr's opinion.

REG'ULUS. A line drawn from the Pole-star, not through the two pointers, but between them and the five secondary stars of the Great Bear, which lie near them, will pass through the bright star in the constellation Leo, called α Leonis, or Cor Leonis (the Lion's Heart). [See PLATE CONSTELLATIONS, Northern Hemisphere.] By Ptolemy and other Greeks it was called *Basiliskos*, the translation of which is the Latin word *Regulus* (diminutive of *rex*, king). Regulus is the twentieth star in the heavens in order of brightness.

REG'ULUS (the bird.) See GOLDCREST.

REH-BOK or RHEE-BOK (*Eleotragus capreolus*) is a gracefully formed South African species of *Antelope* occurring in small herds among the hills and rocks in the neighbourhood of water pools and dried-up rivers. Its legs are slender, and it runs with great swiftness. It stands about 2 feet 4 inches high, and is furnished with straight, slender, vertically-pointed horns 9 inches in length. The fur has a reddish-ash colour, being white underneath the belly; its texture is woolly. The females have four mammae and are hornless.

REI, the theoretical monetary unit of Portugal, and hence also of Brazil. There is no actual corresponding coin, but the real unit of currency is the piece of a thousand reis, the *milreis*. The rei (computing its value from the gold milreis) is worth $\frac{1}{213}$ of an English farthing in Portugal and $\frac{1}{108}$ of a farthing in Brazil, say a twentieth and a fortieth of a penny respectively. The notation of the rei is very peculiar, and is thus expressed:—

Milreis,	1000	reis, written	. .	1\$000
Conto,	1000,000	" "	.	1000\$000
Moidore,	4800	" "	.	4\$800
Crusado nova,	480	" "	.	\$480
Crusado,	400	" "	.	\$400
Testoon,	100	" "	.	\$100

REI'CHENBACH, KARL, BARON VON, a chemist and mechanist, but principally known as the promulgator of some original views on the subject of animal magnetism, was born at Stuttgart on 12th February, 1788, and died in 1866. He studied at Tübingen, where he obtained the degree of doctor in philosophy. He commenced the application of science to the industrial arts, and, establishing a number of factories in Moravia, rapidly amassed a large fortune. He received the dignity of baron from the King of Württemberg. As a scientific man, Von Reichenbach is known as the author of the first geological monograph which appeared in Austria—"Geological Researches in Moravia" (Vienna, 1834); and he discovered paraffin in 1831, and creosote in 1833. He was also a great authority on meteoric bodies, of which he possessed one of the finest collections in the world. He attracted most attention, however, although his scientific reputation was proportionately lessened, by his supposed discovery of a new imponderable force in nature, which he called *Od*. He described it as analogous to electricity and magnetism, and as widely diffused throughout nature. To it he attributed the sympathies and antipathies which dominate men. He believed that the *od* force may be seen in the form of an undulating light, but that there are only certain persons who are capable of perceiving it. To these he

gave the name of *semitaire*. His views were received with distrust and ridicule by the majority of scientific men, but he did not shrink from a vigorous literary warfare in their behalf.

REICHENBERG, an important industrial town in the circle of Bunzlau, in Bohemia, is situated on the river Neisse, 52 miles N.N.E. from Prague, and has 20,000 inhabitants. The principal buildings are the church called Krenz Kirche, two palaces, law courts, a theatre, and a large school-house. There are large woollen cloth factories, with fulling-mills and dyeing-houses. There are besides breweries (one of them the largest in Bohemia), spirit distilleries, manufactories of stockings, hats, linen, and calico.

REICHENHALL, a favourite spa and town in Upper Bavaria, is situated in a romantic country on the left bank of the Saale, at an elevation of 1323 feet above the level of the sea, 8 miles south-west of Salzburg. Though it has not 4000 inhabitants, it is a place of great importance, as being the central point of the four great salt works of Bavaria. The salt springs seem to have been turned to profit since the eighth century. As the great consumption of wood for so many years made fuel too scarce to boil all the brine on the spot, a very ingenious system of hydraulic machinery was contrived in 1618 to carry the brine in iron pipes from Reichenhall to Traunstein, over an elevation of 828 feet perpendicular height, and extending 21 miles in length. A similar conduit 42 miles long to Rosenheim on the Inn, where there is abundance of wood, was made in 1809; so that now all the springs which formerly ran to waste for want of wood are turned to account. In 1817, the salt springs of Reichenhall, Traunstein, and Rosenheim were connected by hydraulic works of great power and ingenious contrivance with the salt mines of Berchtesgaden. The quantity of salt produced annually is 20,000 tons.

REICHSTADT, DUC DE (*François Charles Joseph Napoleon*). See NAPOLEON II.

REID, THOMAS, D.D., was born 26th April, 1710, at Strachan in Kincardineshire. At the age of twelve or thirteen he entered Marischal College, Aberdeen, where he was afterwards appointed librarian. In 1737 he was presented by King's College, Aberdeen, to the living of New Machar in Aberdeenshire.

In 1748 he inserted in the *Transactions of the Royal Society of London* "An Essay on Quantity, occasioned by a Treatise in which simple and compound Ratios are applied to Virtue and Merit." In other words it was an essay against the Hutchesonian application of mathematics to morals. In 1763 he was appointed professor of moral philosophy at Glasgow University. In the same year he published his "Inquiry into the Human Mind on the principles of Common Sense," [see COMMON SENSE], the principal object of which was to counteract the influence of that scepticism which Hume had founded on the spiritual and ideal system of Berkeley. About the same time he received the degree of D.D. from the University of Aberdeen. In 1773 he published—in Lord Kames' "Sketches of the History of Man"—"An Analysis of Aristotle's Logic." His essays on the intellectual and the active powers were published in 1785 and 1788 respectively. He died 7th October, 1796. An edition of the "Works of Dr. Thomas Reid on the Human Mind" was published by Sir William Hamilton in 1817, 8vo.

REIGATE, a market-town and municipal borough of England, in the county of Surrey, is 23 miles south from London, finely situated at the head of the Holmesdale valley, between the chalk and Hastings sand. It consists of one long street, throwing off several minor ones on either side, is tolerably well built, and contains some good houses. The air is salubrious, and the surrounding scenery includes the wooded uplands of Gatton and the bold sweep of the North Downs. Many villa residences have been built near

the town of late years—the place having become a favourite residence for London merchants and others. Reigate Park is an elevation of sandstone, picturesquely wooded, and commanding an extensive prospect. Of the old castle, built by the earls de Waren, captured by Louis of France in 1216, and demolished during the Civil War, the only relic is a barbiican, dug out of the ruins about 100 years ago. In 1874 the grounds, which, from having been a receptacle of rubbish, had been converted into a delightful pleasure ground, were handed over to the corporation and thrown open to the public. In the hillside are excavated some remarkable caverns, which appear to have been used as storehouses, but in one of which local tradition reports that the barons met to arrange the terms of Magna Carta. The church, dedicated to St. Mary Magdalene, was restored in 1858, and the interior is unusually effective. It possesses some valuable manuscripts, and under its chancel is buried Charles Howard, earl of Effingham, Elizabeth's lord high admiral, and the conqueror of the Spanish Armada. The grammar school, town hall, public hall, and several churches, are the chief buildings. The Wesleyans, Baptists, Roman Catholics, and Society of Friends have places of worship. Reigate formerly carried on a considerable trade in oatmeal, no fewer than twenty mills being employed in its manufacture, but this business has altogether declined. Fullers' earth and white sand are found in considerable quantities in the neighbourhood, and there is a large agricultural produce. There is a weekly corn market and a monthly fair for the sale of cattle. The area of the municipal borough is 6015 acres. The population in 1861 was 9975; in 1881 it had risen to 18,662. The town, which includes Redhill, is governed by a mayor, six aldermen, and eighteen councillors. Reigate probably derives its name from being close to the "ridge" of hills along which the the pilgrims' way ran from Southampton to Canterbury. In Domesday Book it is called Churchfelle, or the Church in the Field.

REIGN OF TERROR, the name given to the fearful period between the middle of 1793 and the death of Robespierre, 28th July, 1794. The fall of the Girondins in June, 1793, and the murder of Marat in July had thrown the rule over distracted France into the hands of the Jacobin party in the Convention, led by Danton and Robespierre. We may date the beginning of the actual Terror from the passing of the famous Law of the Suspect (on 17th September, 1793), proposed by Merlin of Douai, which opened the way to all kinds of private malice, giving to all public bodies unlimited power of arrest upon the merest suspicion, even upon anonymous denunciations, of all who by actions, connections, words, writings, or acts seemed to be "not true patriots." Thus were 41,000 unlearned bodies made into tribunals in France at once out of as many townships. "No frightfuller law ever ruled in a nation of men," says Carlyle. The prisons became crowded to the garrets, and the death tumbrils rolled daily to the guillotine. The first deputy to go to the scaffold was Gorsas, 9th October, 1793. The queen, Marie Antoinette, was beheaded a week later. Fouquier-Tinville's revolutionary tribunal worked often far into the night, providing victims for *La Sainte Guillotine*, as the phrase went. The twenty-two Girondin members, the leading men of the moderate party in France, in prison since June, were beheaded in one ghastly batch on 31st October. It was voted in the Convention "Let Terror be the order of the day:" and, which makes the thing more awful, there were open through all this time of bloodshed no less than twenty-three theatres and sixty assembly halls in Paris alone. On 16th November the infamous Philip Egalité, duke of Orleans, went to the scaffold, and two days later there followed, in ghastly mocking contrast, the purest soul of the Revolution, Madame Roland. [See ROLAND.] The rich especially had to fear in these times. Were they plundered? At the first sound of complaint on their part

they became "suspect." Did they give themselves over freely to the spoilers? Then some trumped-up accusation was sure to bring them before one of the 44,000 revolutionary committees, and their money-bags dragged them surely to the Paris guillotine, or to another; for as Barrère coarsely put it in the Convention, in a time of scarcity, "We must coin money on the Place de la Révolution" (now Place de la Concorde, this being the spot where the guillotine stood). Twelve prisons in Paris were not enough to hold the suspects, though 5000 were crowded into them. The guillotine worked continually (*la guillotine va toujours*); little children and aged men were executed. Sometimes Sanson and his "valets" sank down at the foot of their horrible engine, declaring that they were dead beat with the work. In these extremities fusillades were tried, 70 in the first batch, 209 in the second, as at Lyons, Toulon, and elsewhere, under the infamous Collot d'Herbois. Nay, there were counted 210 corpses in the second fusillade at Lyons, and yet one of the 209 prisoners was found to have escaped. The riddle was explained when it was remembered that two men had protested loudly that they were police spies of the Republic and not prisoners at all; but there was not time to bother about investigations of isolated cases, so they had been shot with the rest. Even the Convention could not stand this, and Collot was ordered to proceed singly. Lyons had supported the Girondins, and the vengeance of the Jacobins was thus awful. They even sought to raze the town from the face of the earth, but its firm stone-built houses took much labour to demolish them, and the end of the Terror came before that of Lyons. Far worse was the vengeance exacted on Girondist Nantes. In this unhappy town, after the headsman was exhausted, and fusillades even of as many as 500 at a time had occurred, till there began to be an outcry even among the Jacobins, the execrable ruffian Carrier hit upon the plan of condemning his victims to transportation, and sending them off by night in a flat-bottomed boat—ninety priests the first batch—nominally for Belle Isle, really to be thrown into the river Loire with hands and feet tied, the boats being scuttled at a signal. He reported to the Convention that "the sentence of transportation had been executed *vertically*." Surely brutality could go no further. But yes, women might be stripped naked and tied fast to naked men, and thus flung into the water in "republican marriage," as Carrier named it: and this time 138 were drowned, soldiers attending to fire on any who showed a chance of escaping (11th December, 1793). Grown more bold, Carrier at last carried on these *Nogades* or "drownings" by day! Twenty-five of them occurred in all. They represent the most horrible ferocity of this ferocious time.

At this time, too, churches were generally plundered, and beautiful women dressed as "goddesses of Reason" took their places upon the high altars, while tables loaded with sausages, pork puddings, bread, and wine filled the choir beneath. All who would pressed in to share the "Feast of Reason," and mock the image of the Crucified One and his holy supper with the painted actress and the brutal meal. The children were allowed to get drunk. In the side chapels worse orgies went on. At Meudon they had a tannery of human skins for the manufacture of soft wash leather. The men's skins made leather "superior to chamois," but the women's were found thick and soft, "almost good for nothing," so Montgaillard calmly reports.

These were the outward signs of the Terror: but the heart, the pulse of the whole, was the famous Committee of Public Safety (*Comité de Salut Public*), now made the supreme power by decree of the Convention (September); the nine, or rather now the twelve, members of which, appointed for short intervals and continually re-elected, were quite undistinguished individually. Robespierre even is no exception, for so ordinary a man as he never wielded supreme power before or since. Danton, who, though he

moved the law giving supreme power to the Committee of Public Safety, always himself refused after that to belong to it, really made fair, so far as one can see, to be a remarkable man; but his career was of the briefest. There soon grew up, following these two leaders, two parties in the Convention: Robespierre with the Committee and the Jacobin Club, who were for carrying forward the Terror; Danton and the Cordelier Club, who were for closing the Terror and beginning the work of consolidating France. There was also a third party, whose strength lay in the municipal government of Paris, the *Commune*; and this was led by Hébert, editor of the abominable newspaper *Père Duchêne*. It went for what we now call *nihilism*, the abolition of all rank, wealth, culture, religion, and moral observances—a return to the state of nature, simple savagery. Every commune was to be a sovereign state, 41,000 such states at least in France, and for foreign affairs, &c., a central parliament of delegates was to be constituted. The Feasts of Reason were due to these brutes, as had been the "September massacres," the murder of 1089 royalist prisoners in the Paris prisons, in the hundred hours from Sunday evening, 2nd September, 1792, onwards through the week, the ghastly prelude to the first assembling of the National Convention. The massacres had been the work of the Paris mob under Marat; the leader was now changed, but the mob was the same. At first, during the Terror, the mob had the best of it. But Robespierre and the Committee of Public Safety, whose rule was thus violently threatened, eventually gained the mastery. On 15th March, 1794, a *coup d'état* imprisoned Hébert and all the other leaders of the *exagérés*, and nine days later saw them at the guillotine. Danton, willing enough to see disorder put down, retired to Arcis, and had nothing to do with the execution. A friend of his, a member of the famous Committee itself, remonstrated openly, and Camille Desmoulins in his journal asked why there could not be appointed a Committee of Mercy? It was manifest to Robespierre that the time had come to strike again. On the 30th of March all the Dantonist leaders were arrested by order of the Committee of Public Safety. Danton was thirty-five, Camille thirty-four—young men, like so many leaders of the time. The trial was phenomenal. Danton, quite the master of the situation, tore into shreds the flimsy accusations brought against him; Camille, with delicate irony, made fun of them. The Committee, at its wits' end, after two days' of this pressing danger, brought forward the shameful decree that "if men insult justice they may be ruled out of the debate," and the Convention passed it. Danton, thus silenced, was at last condemned, as it were, in his absence. All were guillotined on the same day of the sentence, 5th April, 1794.

Robespierre was now supreme, and there was no longer the necessity for so much bloodshed. The Committee was so poor in capacity that he rose above the rest of the members by head and shoulders, mere vain pedantic fop though he was. Eleven armies were on foot, young Bonaparte in Italy was doing wonders, the Pyrenees on the one side, Belgium on the other, were succumbing to France. Robespierre thus redressing the external glories of France, determined to raise its moral tone also. He got the Convention to pass a formal decree recognizing the Supreme Being and the immortality of the soul, strangest of Acts of Parliament, and himself officiated as a sort of high priest, in a sky-blue coat, at a great festival in honour of the new Parliamentary god, 8th June, 1794. Ridicule and opposition showed him that his ideas were not so all-powerful as he thought. He determined to root out his opponents—to set on foot the Terror again, in fact. The Convention resisted, and he withdrew from public life, appearing very rarely at the Committee. But this freed his colleagues, who did not share the glimmer of statecraft that Robespierre possessed. They, fearing for their own heads, resumed the methods of

the Terror; and what is especially named the Great Terror is the time of this rule of the Committee without Robespierre, during June and July, 1794. "Plots in the prisons!" was the parrot-cry of the Committee; the twelve prisons held 12,000 prisoners now (instead of their former 5000), and there was consequently horrible overcrowding and revolting squalor. Meanwhile Fouquier-Tinville, the judge of the Revolutionary Tribunal at Paris, could not condemn victims fast enough for the Committee. The tribunal was divided promptly into four parts, so that the work might be fourfold. Large batches (fifty four on 17th June, 1794, for instance) were executed; and Fouquier-Tinville promised to manage 150 at once by help of a new guillotine of improved velocity. All this time Robespierre kept apart, revolving what schemes of reorganization or *coup d'état* one knows not, and can never know. He had been to no official public sitting for six weeks, speaking, however, in the Jacobin Club, and accepting from the club a guard of men with sticks, for fear of danger. At last a list of forty names was found, or said to be found, in his pocket, names of his opponents in the Committee. One who was named on it, Carnot the war minister, found it when he and Robespierre were at a dinner party on a hot day and coats were taken off. Be this as it may, Robespierre, on ascending the tribune in the Convention 26th July, 1794, after his long absence, to propose that a stern last search for traitors be made, was met with silence. He saw that a crisis had come. Next day, 27th July, as he tried to speak, he was refused a hearing, was accused of driving at dictatorship, &c., and imprisoned with all his chief comrades. In the evening he was delivered by the Commune of Paris, and taken in triumph to the Hôtel de Ville. The Convention sat all night, decreeing the Commune and the Robespierists outlaws, and calling their forces together to crush this important revolution. At three in the morning of 28th July, the 10th Thermidor, 1794, the armed forces of the two sides met in the Place de Grève before the town hall. Henriot, in command of the *gendarmes* of the Commune, is said to have been drunk. At all events on the proclamation of outlawry being read, there was hesitation among his troops. He rushed into the town-hall crying to his comrades, "All is lost!" They, enraged at his incompetence and seeing their own failure, flung him out of the window. Some jumped out too, falling, like Henriot, into a cesspool; others tried to hide; Robespierre tried to shoot himself. All were taken, foul, bleeding, insensible, just as they were, flung into a cart, and after being identified were taken off to the guillotine, some twenty-three of them in all. The "tail of Robespierre" at once followed on the ghastly journey; and then the Terror stopped.

The prisons were quickly emptied, the hidden fugitives came forth, amnesty was proclaimed to the rebels, the Commune of Paris was reorganized. The work of Carrier at Nantes was exposed to the general horror, and he was executed for it in December, 1794. Fouquier-Tinville followed, with his sixteen chief jurymen and assistants, in April, 1795. Collot d'Herbois and others were transported to Cayenne in the next month, and Collot died on the voyage from drinking a bottle of rum at one draught when he was thirsty. In the previous January the Convention had decreed the close of the Jacobin Club. Jacobins had now to hide for their lives. Lists of the persons guillotined were published, but only amounted to 2000. Abbé Montgaillard asserts angrily that this is an understatement, that there were at least 4000, reckoning those fusilladed and drowned; of these he computes 900 were women. Whereupon Carlyle remarks, "Near upon the two-hundredth part of what perished in the Seven Years' War, by which the great Fritz wrenched Silesia from the great Theresa." Not that the great writer would minimize the Terror, but that he would show us, in his trenchant way, what is the

real upshot of war (of whose horrors none of us know really anything, save the soldiers only), by comparing it with this dreadful scourge of the Terror, of which we do know something, and which we can in a dim way realize. Could the lesson strike home, few wars but those of defence would ever be undertaken "with a light heart," in the manner that the French statesman undertook the great war of 1870.

The Reign of Terror was the triumph of the baser passions, very little above mere mob-rule. It is so near to us, and there were so many competent witnesses on both sides, that we know it fairly well. We know also that the destruction of the "old régime," of the tyranny of the feudal lords, of the privileges and immunities so unfairly possessed by the clergy and nobility, who held all the land to the exclusion of any of ungente birth, who lived luxuriously lives yet never paid a tax, and were even subject to different laws to the commonalty; in short, of the monstrous incubus of *siécles*, of all kinds of oppression, immorality, and corruption which had made France rotten to the core, was the outcome of the French Revolution. Are we then to say that the Reign of Terror, horrible as it was, was, like war, a necessary evil, serving the purpose of an awful scourge?

The answer to this is given by a careful study of the whole movement. The Reign of Terror was the triumph of Jacobinism. All the good of the Revolution had been done before the National Convention assembled, and was the work of the men of 1789. The Jacobins in 1792 really made a second revolution, overthrew the good work of their predecessors, and as soon as they got the upper hand, did the mischief which unthinking persons set down to the score of the Revolution as a whole. Jacobinism destroyed the new constitution, which had been framed with care; destroyed the local government, which the first revolution had carefully fostered, and in its stead cursed France with a new centralization, which in time paved the way for the Napoleonic tyranny; destroyed liberty and favoured authority; destroyed the church, and favoured for the most part a mocking atheism, or at the best effete Feasts of the Supreme Being, and the like. The Revolution of 1789 was, on the whole, a beneficial movement; the Reign of Terror was an unmitigated curse—without any central idea to give it a palliation—without a great man, such as Napoleon (who, in the matter of mere tyranny and bloodshed was twenty times as bad as the Jacobins), to gild it with glory.

We have given above the contemporary estimate of the deaths under the Terror, namely, 4000. Then the confusion was so great, and the loss or absence of records so universal, that errors of great magnitude could not fail to be made. We now know, thanks to the diligence of many inquirers, the real numbers who perished, within a very limited margin of error. The latest, and in many respects the fairest (and therefore the best), historian of the Revolution, M. Taine, gives the following figures in the third volume of his "*La Révolution*" (Paris, 1885):—

At Paris itself, between 16th April, 1793, and the 9th Thermidor, there were guillotined 2625 persons. The same process went forward all over France. In Arras, 299 men and 93 women; in Orange, 331 persons; in Nantes, 1971; in Lyons, 1684 (avowedly, but a correspondent of Robespierre estimates the total at 6000); in the *fusillades* of Toulon more than 1000; in the *noyades* of Nantes nearly 5000 perished. In the eight départements of the West it is reckoned that nearly half a million perished. As to the misery caused by the Jacobin government, M. Taine believes that the deaths *from want* much exceeded 1,000,000. He holds that at the time of the fall of Robespierre France was on the brink of a great famine on the Asiatic scale, from which she was only preserved by certain accidents, which he enumerates, the chief of them being the abandonment of the Jacobin system.

But may we not at least say that the Jacobins saved France by their energetic management of the war? On the contrary, they almost ruined France by forcing her into a war which she could easily have escaped, and by repeatedly, for their own purposes, frustrating the hope of peace. During the war it so happened that an able administrator and strategist, who was in no strict sense a Jacobin, Carnot, devoted himself in the Committee of Public Safety to the organization and direction of the revolutionary armies; he was regarded with suspicion by his colleagues, of most of whom he himself speaks with abhorrence; but by his exertions the ruin was averted which the incapacity of Robespierre and St. Just would have brought on. On all hands, therefore, we may decide that this fearful movement was, as we have called it above, an unmitigated curse to France, and through her to society in Europe.

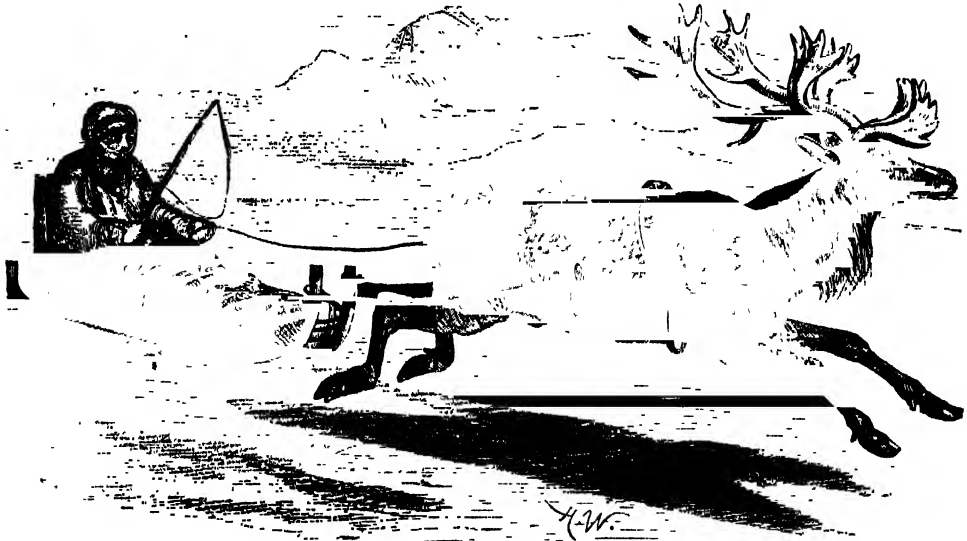
REIKIAVIK, meaning "reck (or smoke) town," a small town on the west coast of Iceland, situated on a tongue of

land in the Faxaflord. It is the capital and residence of the governor and principal authorities of the island, and is a bishop's see. The chief buildings are a large church, a cathedral, a lyceum, observatory, a public library, and a literary institute, called the Icelandic Society. It engrosses the greater part of the trade of the island, and has a very commodious harbour. Mean temperature, January, 29° 8'; July, 56° 6' Fahr.

REIMS. See RHEIMS.

REIM'THURSES, the Frost-Giants of the Norse mythology. See HRIMTHURSL.

REINDEER (*Rangifer tarandus*) is a species of DEER inhabiting the most northerly parts of both hemispheres. In America, where it is called Caribon, it extends through Greenland, Canada, and Newfoundland. It exists in Norway and Sweden, but is there smaller and less powerful than in Lapland and Finland. It is not a native of Iceland, but has been successfully introduced into that island. In Lapland especially it is completely domesticated, rival-



Reindeer Sledge-travelling.

ling in utility the cattle of temperate climates and the camel of the desert.

The reindeer is a large heavily built animal, standing about 3 feet high at the shoulders. The limbs are short. The hoofs are broad and widely cleft, and the false hoofs are well developed, so as to strengthen the foothold on the snow. The neck is stout, and supports a pair of enormous antlers, which vary considerably in branching. The beam is curved upwards and forwards, nearly 5 feet in length, and usually palmated at the extremity. One of the brow-tyes is generally aborted, and the other is greatly palmated and directed forward in the middle line of the head. Contrary to the general rule in deer, the antlers are developed also in the females, but they are more slender, smaller, and scarcely at all palmated. The fur varies in colour, being always lighter in winter. It is generally deep brown with a white band on the legs above the hoofs; but sometimes the whole body is white. The outer coat is made up of long, harsh, brittle hairs, while under is fine close woolly under-fur. The muffle is clothed with hair. The reindeer is migratory in its habits, spending the summer on the mountains and seeking the plains and woods during the winter. During the autumn migrations great numbers are killed for the sake of their flesh, as they are then in the best condition. They feed chiefly on lichens.

The services which the reindeer render the Laplanders are well known. Harnessed to a sledge, such are their speed and endurance that they will perform a journey of 80 miles in a day over the frozen snow. The skins furnish the Laplander's clothing, and the flesh is his principal food. Attempts have been made on several occasions to introduce the reindeer into Scotland, but without success.

REINDEER MOSS (*Cladonia rangiferina*) is a LICHEN very frequently found in Great Britain on moors, heaths, and mountains. Its botanical characters are very variable, more especially the colour and the length of the ramifications. This plant is the principal support of the reindeer in its native countries, and hence its common name. In Lapland there is no plant so abundant as this, especially in the pine forests, where it covers the surface of the soil for many miles together like snow. On the destruction of the forests by fire this plant continues to grow, and then reaches its greatest luxuriance. In such districts the reindeer are principally pastured in the winter, and whatever may be the depth of snow, these animals are enabled to obtain their food by grubbing with their noses through it. The Laplanders are also in the habit of collecting this lichen with rakes in the rainy season, when it is flexible, and readily separates from the ground where it has grown. They use it as fodder for their cattle.

REINDEER PERIOD, in geology, the term applied by Lartet, in 1863, to the lapse of time between the Palæolithic and Neolithic divisions of the **STONE AGE**, represented by certain deposits in the caverns of Southern France. Remains of the reindeer are particularly abundant in these accumulations, and hence the name.

REINEKE FUCHS (or "Reynard the Fox") is a poem which, during the latter part of the middle ages and the early centuries of modern times, in some form or other, was known and read all over Europe. The first complete version of the story was printed in 1498 at Lübeck, and bears the title "Reynke de Vos." It is written in the Frisian dialect, which is a modification of that spoken in Lower Saxony. The poem contains a lively picture of a court, in which the prince allows himself to be guided by the flattery of a deceitful and cunning favourite, who, notwithstanding all the wrongs that he inflicts upon others, is still successful to the last. The king is represented under the name of Lion; his friend and favourite is Reineke the Fox. Isegrim the Wolf is also a prominent personage in the "epic of the beasts."

The first edition is preceded by a prose introduction, in which the author of the German version calls himself Henrick van Alkmer, and states that he translated the story. But no trace of this Alkmer can be found, the statement of Rollenhagen, who, in the preface to his "Froschmatteler," calls Nicholas Baumann the author of "Reynke de Vos," has generally been adopted, though others credit a certain Hermann Barkhusen, town-clerk and printer in Rostock, with the composition. Goethe has made an excellent modernized version of "Reineke Fuchs" into German hexameters (1794); and Simrock published at Frankfurt in 1845-52 a clever translation in rhymed iambic couplets, the metre of the original. Arnold translated Goethe's version into English verse in 1855. The whole subject forms the theme of one of Thomas Carlyle's finest and most appreciative essays.

There were previous prose versions in various Netherlandish tongues, one of which, in Dutch, published at Gouda in 1479 under the title of "De Hystorie van Reynaert de Vos," was translated into English as "Iyer begyneth Thystorye of Reynard the Foxe," by Caxton (1481). The earliest appearance of the story is in Latin verses of the twelfth century made by Flemish monks, some on *Isegrimus*, the wolf, others on *Reinardus*, the fox, the latter about fifty years later than the former in date. Then we get a High German poem ("Isegrines Not") by Henry the Glichezary, or troubadour (1170), and a Flemish poem ("Der Reynaert") a little later. From these two sources come all the various versions, until the story reached its culmination in the famous "Reynke de Vos" of 1498.

History preserves remarkable instances of opposite ironical quotation from the earlier Renardine series, and when translations and printing sent the final form of the legend all over Europe with its parodies of feudal society, it would everywhere find readers prompt to fit the caps on the heads of countrymen of their own. "In this historye," begins Caxton's version, "ben wroten the parables, good lerning, and dyverse poyntes to be merkyd, by which poyntes men may lerne to come to the subtil knowleche of such thynges as dayly ben used, and had in the counseylls of lordes and prelates, gostly and worldly; and also amonge marchantes and other common peple." Even in Goethe's time the old epic's irony against despots and their ministers and courtiers, against signorial nobles, prelates, and monks, was not obsolete, and could gain a new pungency applied to the contests of the day.

But no English version of "Reineke" offered us to-day can make its way with the public through the appositeness of the satire. We may thankfully say that all that old-world society has forever passed away. Still the "Reineke Fuchs" holds its popularity by virtue of its sheer literary

merit. Herder—no mean judge—ranked it as an epic on a par with the *Odyssey*. But it needs reverent handling, and this it has not received in the slipshod, diffuse, and almost comic version of the latest English translator, Mr. Douglas Ainslie (1886). It is true Goethe describes his "Reineke Fuchs" as "between a translation and a recasting;" but while Goethe altered the metrical form of the Old Saxon poem, substituting hexameters for its rhymed couplets of varying lengths, he scrupulously preserved the context. He did but clarify the original, mildewed by time, and ran it undiluted into the new mould. His execution is, in truth, so exact that it is easy for any Englishman with a little knowledge of German to read the Old Saxon text, word for word, by comparing it with Goethe's rendering.

REISSIGER, KARL GOTTLIEB, a musician, born at Belzig, near Wittenberg, on the 31st January, 1798, and died at Dresden, the 7th November, 1859. Being too poor to hire a pianoforte as a boy, singing in the St. Thomas Schull, Leipzig, Reissiger pursued his musical studies with great difficulty. At last the organist Schicht gave him a systematic course of lessons in composition, and raised a subscription to allow him a pension for three years which would enable him to pursue his studies without embarrassment. Reissiger, thus provided for, in 1821 went to Vienna, and proceeded to Munich in 1822, in order to place himself under the tuition of Winter. After working very hard and with fair success he went to Berlin, where he was most kindly received; from thence he sent "Didone" to Weber at Dresden, under whose care it was produced with much applause. He was commissioned by the Prussian ministry to visit France and Italy to examine and report upon the musical seminaries in these countries preparatory to the organization of a conservatorium in the Prussian capital, and he started on this tour in July, 1824. At Paris he published his first trio for pianoforte, violin, and violoncello, Op. 25, and obtained considerable success as a player and composer. His scheme for a conservatorium was approved, but never carried into effect. In October, 1826, he went to the Hague, whither he was invited for the purpose of reorganizing the musical academy. He relinquished the engagement to go to Dresden where, in 1827, the king conferred on him the office of kapellmeister, which had been vacant since the death of Weber, and this he filled till the end of his days. His fame as a dramatic composer commenced from this time. He brought out several operas, an oratorio called "David," masses, and other pieces for the church, a symphony, an immense number of songs, and a large quantity of chamber music, among which his pianoforte trios have specially been distinguished.

REIT-BOK or **RIET-BOK** (*Electragus arundinaceus*) is a South African species of ANTELOPE, inhabiting thickets and reedy places near water. It stands 3 feet high, and measures nearly 5 feet in length. The horns are about a foot in length, round and ringed at the base, and slightly curved forward. The tail is about 11 inches long. The fur is of an ashy-gray, lighter beneath. The females are smaller than the males, have four mammae, and are hairless. The reit-bok is usually found in pairs or small families.

RELATION, FALSE, in music. See FALSE RELATION.

RELATIVE KEYS, in music. See SCALE.

RELATIVE PRONOUNS. See PRONOUNS.

RELICS (in Latin, *reliquia*) is a term used to signify the remains, bones, or garments of departed holy men, which are honoured by the followers of the Church of Rome. In the fourth and fifth centuries astonishing miracles were said to be performed by fragments of their bones or garments, and pilgrimages were undertaken to obtain these relics. The use of images and that of relics

as accessories to church worship seem to have grown up together during that period, till it became, during the middle ages, a vulgar superstition and disgraceful traffic, and the abuse has been censured by many sincere Roman Catholics. Pope Innocent III. forbade the sale of relics. The Roman Catholic Church, however, admits that the relics of saints have performed, and may still perform miracles, and that they are a proper object of veneration. The Greek and other Oriental churches, and most of the Oriental sects, agree with Roman Catholics in the practice of relic worship. Mohammedanism especially favours it; for the holy cities of Mecca and Medina, and the Mosque of Omar at Jerusalem, owe most of their sacredness to the memorials and relics of the Prophet which they contain.

RELIEF. See ALTO-RELIEVO and BAS-RELIEF.

RELIGION is a Latin word which, according to the common derivation of it (from *religare*), means a principle which binds or acts as a *restraint* on the conduct of man. In its more general sense it is used to denote our ideas of the existence and character of a Divine Being, to whose power men are subject. Thus we speak of a *sense of religion* and the *duties of religion*, and we call a man who regards such subjects as matters of great importance a *religious person*. But as different views have prevailed of the nature of the Deity and the relation in which man stands to him, various systems of religious belief have sprung up, and each of these systems is called a *religion*. Thus we speak of the Greek, Hindu, Jewish, Christian, and Mohammedan religions. The word is also popularly used to express the attention of individuals to the doctrines and duties of the particular religion which they may have embraced. In this sense it is synonymous with *piety*.

The subjects with which religion has to do are God and man considered in the relation in which they stand to each other. It consequently includes all the questions which can throw light upon that relation; for example, the nature of the Deity, the notions of infinite space and infinite duration, the existence and offices of spiritual beings, the origin and destiny of the human race, the immateriality and immortality of the human soul; and also all the practical questions which arise out of that relation, such as the duties which men owe to God and to each other, and the consequences which God may have appointed to follow different courses of action. All impressions, notions, and belief upon these subjects, whether formed into a system or not, constitute what we call *religion*, as distinguished from *theology*, which is the science by which these ideas are reduced to a systematic form, their laws investigated, and their origin and results traced out.

The sources of religious notions are either the laws of nature and the constitution of the human mind, or direct information given to us by the Deity himself, whether such information be embodied in any lasting form, or handed down from one generation to another by oral tradition. Religion derived from the two former sources is called *natural religion*; from the last, *revealed religion*.

The existence of a God once admitted, the next question is, In what relation do we stand to him? Are any laws laid down for our conduct? Are we responsible to him for keeping or breaking these laws? Are any rewards and punishments appointed for obedience and disobedience?

To these questions it does not appear that natural religion can give a perfectly satisfactory answer, though Bishop Butler's well-known work, "The Analogy of Religion, Natural and Revealed, to the Constitution and Course of Nature," shows how much information on these subjects may be derived from the examination of the constitution and order of things. It seems also that a general undefined notion of responsibility is associated in nearly all human minds with the idea of divine existence, at least a *sense of responsibility* sufficient to excite pleasure when we do what we believe to be good, and remorse when we do

what we believe to be evil. Again, the connection which generally exists between vice and misery on the one hand, and virtue and happiness on the other, impresses upon us the idea that there does exist such a thing as retributive justice. But though the general law by which the affairs of the world appear to be governed is, that virtue is followed by happiness, and vice by misery, and though a full knowledge of the circumstances of every case which appears an exception to that law might show us that more real happiness is enjoyed by a virtuous sufferer than by a prosperous sinner, yet daily experience furnishes us with exceptions to this law, numerous enough to throw great doubt upon its reality, if the period of human existence ends with the present life. Accordingly we find the doctrine of a future state forming a part of nearly all religious systems, and generally connected with some notion of rewards and punishments. And this again is a branch of religion which, though it may be made to appear probable by arguments drawn from the nature of things, does not appear to be susceptible of satisfactory proof without a divine revelation. In the opening of the Epistle to the Romans, there is an admirable though concise argument on the force and extent of natural religion (Rom. i. 19).

On whatever grounds systems of morality may be based by ethical writers, there is in the minds of men in general an inseparable connection between religion and morality, the former furnishing alike the rule and sanction of the latter. The positive morality of any people will always depend on the nature of their religion. The attributes which they attach to the divine character will be a standard for their own conduct, and their opinions respecting the recompense appointed for virtue and vice will determine the strength of the motives on which they act; while their moral system will be greatly affected by their views upon the subject of satisfaction for guilt. When, as is generally the case, the same religious principles are found to pervade a whole community, the positive morality which is formed upon those principles has a direct influence on legislation, and the sanctions and rites of religion co-operate with the rules of law, and thus religion becomes interwoven with the social and political system. The different views which are taken of human duty and responsibility, and of the future state of existence, are generally found to depend upon the light in which the Deity is regarded. It is not to be expected that men should measure their conduct by the standard of a purer morality than is furnished by the characters of their gods. Those religions which are based upon the doctrine of the unity of the Deity are chiefly distinguished from the polytheistic systems by their regarding the divine nature as utterly distinct from all material existences, and as incapable of being represented in any way by means of sensible objects. Hence the Jewish and Christian and Mohammedan religions are irreconcilably opposed to all forms of idolatry.

It is only within recent years that the various religions which have existed and still exist in the world have been made the subjects of original scientific research and comparative study. The bibliography on the subject is now very extensive, and we have only space to mention the following as among the most important works:—Max Muller, "Introduction to the Science of Religion" (London, 1878), and "Origin and Growth of Religion" (1878); Burnouf, "La Science des Religions," fourth edition (Paris, 1885); Réville, "Prolégomènes de l'Histoire des Religions" (Paris, 1881, translated into English in 1885); Pfleiderer, "Religions Philosophie auf geschichtlicher Grundlage" (Berlin, 1884); Freeman Clarke, "Ten Great Religions: an Essay in Comparative Theology" (Boston, 1871); Fairbairn, "Studies in the Philosophy of Religion and History" (London, 1876). The chief religions of the world are described in separate articles, such as CHRISTIANITY, BUDDHISM, and MOHAMMEDANISM.

RELIGION OF HUMANITY. See POSITIVISM.**REM'BRANDT HARMENSZOOM VAN RIJN,**

was the son of a millor, Gerrit Harmen van Rijn. He was born in 1606, on the banks of the Rhine near Leyden. When very young he was sent to a Latin school, but showing a distaste for scholarship and decided talent for painting, he was placed with Jacob van Swanenburch, and subsequently with Pieter Lastmann and Jacob Pynas to study that art. In 1630 he settled in Amsterdam, where he resided the remainder of his life, and married in 1634 Saskia, daughter of the burgomaster of Leeuwarden. He loved to paint the portrait of this wife, but still more that of his old mother. Saskia died in 1612, and Rembrandt is believed to have married a second time in 1653. Although he studied under artists of repute he was really entirely his own master. The well known peculiarities of his effects of light and shade are supposed to have been derived from the pictorial impressions left upon his mind by his early experiences in his father's mill. The necessity of paying over his son's inheritance, as his first wife's money passed to her child in case of a second marriage, coupled with his own extravagant habits as a collector of drawings and other objects of art, together probably with hard times, involved him in overwhelming difficulties, and in 1656 he was publicly declared insolvent. His son took possession of the house in the Joden-Breestraat, and eventually recovered what was due to him in 1665—about £600; but Rembrandt from this time to his death seems to have remained in poverty and in comparative obscurity. The stories about his miserly propensities, originally spread by Honbraken, but greatly exaggerated by modern writers and romancers, appear to be pure scandal. He continued hard at work painting and engraving till his death in the beginning of October, 1669.

Rembrandt was one of the most original and able painters who ever lived; he excelled chiefly in colour and in light and shade, and was also a perfect master in execution. Except where refinement of taste in form was required, his powers were almost magical; and he was as remarkable for his etchings as for his pictures. He is seen to great advantage in the national galleries of Amsterdam, the Hague, and London. The National Gallery has signed examples from 1640 to 1666, showing all his styles, elaborate, careful, and coarse, in small and large figures, including two interesting portraits of himself, at an interval of nearly thirty years between them, and a superb portrait of his mother, as well as other grand works. His wonderful etchings, amounting to nearly 400, bear dates from 1628 to 1661. To show the value of these prints, it may be added that a fine specimen fetched £1180 in 1867. Our National Gallery has an almost unrivalled series of Rembrandt etchings in its Print Rooms. Both these and his pictures are too vast a subject for further detail here. He had many scholars and imitators who approached him very closely in manner, as G. Van der Eeckhout, F. Bol, G. Flinck, and others.

REMINIS'GENCE. See MEMORY.**REMIT'TENT FEVER.** See FEVER.

REMON'STRANCE, the name given to two important protests presented to Charles I. by his Parliament. The first was presented in 1628, and was known as the *Short Remonstrance*, soon, however, developing into the more famous form of the *PETITION OF RIGHT*.

The *Grand Remonstrance* was the second great work of the Long Parliament—the first having been the attainder and execution of Strafford. It was brought in by Pym himself ("King Pym"), November, 1641, and demanded securities for the non-recurrence of the ill-government which it pointed out. The king, his power already shaken by the successful attack on his favourite minister, resisted the measure, through his adherents, to the utmost of his power. Debates were heaped upon debates till, for the first time in

the history of the House of Commons, lights had to be brought in. At midnight it passed, and then only by a majority of eleven. "Had it been rejected," said Oliver Cromwell, "I would have sold to-morrow all I possess, and left England for ever." The excitement in the House was prodigious, for all felt that it determined the crisis of the struggle. The royalists began to bluster, and the parliamentarians waved their hats in reply, swords were drawn on both sides, though the points were held against the ground. Hampden's authority alone prevented a scene of violence. Charles threw down the mask, endeavoured to arrest the five chief members concerned in the following January, and on his failure soon raised the standard of civil war at Nottingham.

REMON'STRANTS. See ARMINIUS.

REM'ORA (*Echeneis*) is a genus of fishes belonging to the *MACREL* family (*Scombridae*), distinguished by the modification of the spinous dorsal fin into a flat oval adhesive disc on the top of the head and neck. This sucking organ consists of a number of transverse ridges or lamellae, each pair being formed of a single spine; the whole disc is surrounded by a membranous raised fringe. By means of this sucking organ the remora or sucking-fish is enabled to attach itself to sharks, whales, turtles, ships, &c.; and the attachment is so strong, owing to the vacuum formed by the erection of the lamellae, that it can only be dislodged with great difficulty.

The remora is a bad swimmer, and allows itself to be carried about by faster moving objects in preference to moving by its own exertions. It is not, however, a parasite, though doubtless its attachment to a shark or a ship brings it in the way of a ready supply of food. This fish was well known to the Greeks and Romans, and many marvellous tales were told of it. Pliny tells many stories of a single remora being able to check the passage of a large ship; indeed, if he is to be believed, the battle of Actium, and in consequence the fate of the Roman world, was decided by the staying of Antony's galley by a remora. It was also thought to be able to delay lawsuits. It is said that in the Mozambique a species of remora is employed to catch turtles. A ring with a long cord attached to it is fixed on the tail of the fish, which is carried out to sea in a bucketful of salt water. As soon as a turtle is perceived asleep on the surface the fishermen paddle towards it very gently, until they come sufficiently near, when they throw out the remora, which makes for the dormant turtle with speed, and fastens on it so strongly that both can be drawn to the boat and secured.

The remora has an elongated, slender body, covered with very small scales, and the tail has no keel. The head is depressed and the mouth is of moderate size; there are villiform bands of teeth in the jaws, on the vomer and palatine bones.

Ten species of this genus are known from temperate and tropical seas. Two species occur, though not very commonly, in British seas, *Echeneis remora* and *Echeneis naucrates*, the former attaining a length only of 8 inches, and generally being much smaller, while the latter is often as much as 3 feet long.

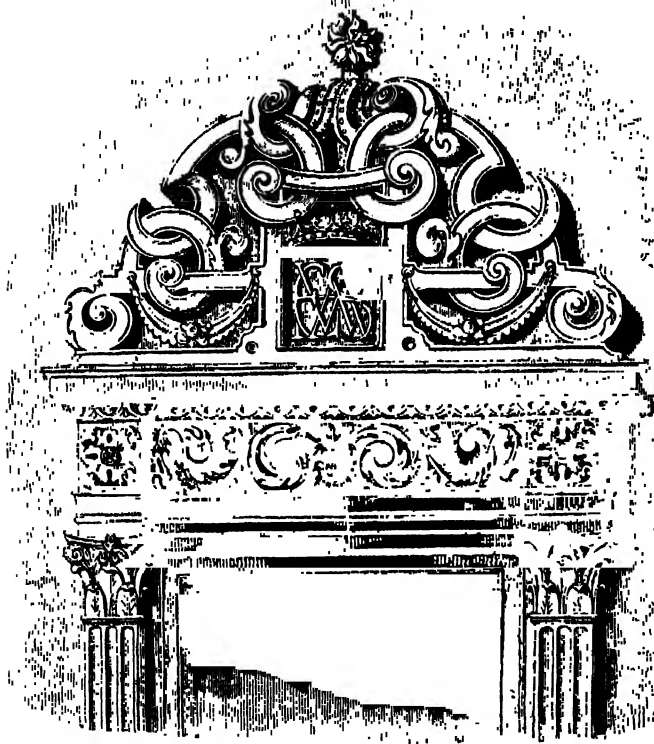
REM'SCHEID, a town of Germany, in Rhenish Prussia, situated 20 miles north-east of Cologne. Its only importance is derived from its extensive hardware manufacture, which has given it the name of the Rhenish Sheffield. In 1881 the population of the town was 30,029.

RE'MUS. See ROMULUS.

RENAISSANCE. The term *Renaissance*, or in English *Renascence*, indicates the period of the revival, when the classic began to be re-introduced after the mediæval styles, and is often used as synonymous with the term *Cinque-cento*, which literally means five hundred (*mille*, a thousand, being understood though not expressed). It therefore signifies the style of architecture and general

decoration which prevailed during the fifteenth and sixteenth centuries.

The beginning of the Renaissance style in England is in that alteration of Gothic known as Tudor, which soon deviated still further into the well-known Elizabethan style. Granted that the mixture of Gothic and classic art is incongruous, yet anything which gives us such charmingly picturesque results as Hatfield, Burleigh, Audley, End, &c., must be welcomed by all but the mere purist in art. The old redbrick, heavily chimneyed and gabled buildings, their large windows divided by bold mullions and transoms, and their simple noble outlines, are among our best-loved treasures in architecture. Who cannot feel a glow of delight at the great halls with their splendid oriel window or noble bay, the fine plastered ceilings divided by heavy beams of timber, the wide oaken staircases with carved balusters, ornamented newel post, and heavy handrail, the magnificent sculptured wooden chimney-pieces, reaching from floor to ceiling? More refined, but less characteristic, is the contemporary French style, the "François premier;" and a typical example of the German architecture of the time is seen in the well-known Castle of Heidelberg.



Winton House.

In Italy Renaissance architecture almost at once took a decided leap; there is but little of transitional forms, such as those just mentioned. The marvellous pile of the Certosa (begun in 1472) is the greatest instance. The great palaces of Florence, decided in style as they are, were all built by the first quarter of the sixteenth century. By the middle of the century Michelangelo had set his stamp upon St. Peter's, and the grandest type of Renaissance architecture had been produced. The noble Roman palaces followed, and contemporary with them the Renaissance churches and buildings at Venice, such as St. Maria della Salute, the Library, &c. The superb marble palaces

of Genoa were planned before those of Rome, modern as they look, and a large number are due to the genius of one man, Alessio.

In France the Louvre (1544), the first designs of which were by the Italian Serlio, created a style which became almost national. A little later the Hôtel de Ville was built at Paris, and was a great monument of the style till it was burnt down by the Communists in 1871. The old part of the Palace of the Tuileries (burnt at the same time) was also built at this time (begun in 1564). With Louis XIV. we get the dull Versailles, but the striking Invalides.

In England the earliest buildings at all dignified with the fully developed Renaissance style, are parts of Caius ("Keys") College, Cambridge. Inigo Jones brought the purer taste of Palladio and the later Renaissance into vogue, and his masterpiece of Whitehall (the Banqueting Hall, one mere fragment of a vast and noble design) is known to and admired by every one. His successor, Christopher Wren, is immortal by virtue of his triumph of Renaissance-classical design—St Paul's Cathedral, which stands only second to St. Peter's as the crowning glory of the complete style in its highest splendour. But the

classical style quickly degenerated into mere copying from ancient monuments, and very few such noble examples as those of Whitehall and St. Paul's exist. On the other hand, many fine houses of the earlier Renaissance style are dotted all over England. The city of Chester may be especially mentioned for its wealth in this respect; though the style is very mixed, the upper overhanging storeys, and the treatment of timberwork, still remaining largely Gothic. The whole effect is most rich, even though it is so irregular. By the time of James I. the Gothic timberwork had died out, and the special Renaissance ornament of moulded plaster or stucco had been imported from the Italian style (Raffaello's work of this kind in the "loggia" of the Vatican will be remembered by all who have had the good fortune to see it). Lintels and over-lintels of doorways became very beautiful. Many of the Cambridge colleges yield good examples, as also do some of the later Oxford colleges. We give a fine doorway from Winton House as illustrative of this style. A reaction set in, in the following century, towards a semi-Gothic style—red brick was again largely used, gables were erected at every possible corner, queer dormer windows and external wooden balustrades were sought for, pilasters and cornices of cut bricks were admired, &c. This is the "Queen Anne" style of late Renaissance; and its reappearance in the latter part of the present century is one of the marked signs of improvement of taste. "Queen Anne" houses may not be in the purest style, but they are at least picturesque and well coloured, and afford endless opportunities for originality—qualities which the classically-iniunctive period of the beginning of the present century entirely lacked.

Although usually employed in connection with architecture, with which indeed the movement truly began, the term Renaissance is also used of fifteenth and sixteenth

century art in general. The same mixture of elements, the same inventiveness and richness, even to luxuriance of ornament, the same love of bright colour and irregular striking outline, runs through the poetry, the painting, the carving and enamelling, the costumes and manners of this "new-birth" epoch when men were awakening from the sleep of the middle ages.

The Renaissance was purely Italian in its first origination—though it afterwards spread, as has been attempted to be shown, into all lands. It is still best studied in its Italian manifestation, as no other country can show such a full development from dawn to eventide. It is clearly divisible in Italy into four strongly marked epochs, which may be briefly indicated as follows.

First Epoch: Rise (1225-1400). In architecture and sculpture—Niccolò Pisano, followed by Giovanni and Andrea Pisano, Arnolfo di Cambio, Giotto, Orcagna. In literature—Dante, Petrarca, Boccaccio. In painting—Cimabue, Andrea Tafi (mosaics), Giotto, Duccio, Simone, Memmi, Taddeo and Agnolo Gaddi, Spinello of Arezzo.

Second Epoch: Development (1400-75). In architecture—Brunellesco, Michelozzo, Alberti, Baccio Pontelli. In sculpture—Jacopo della Quercia, Ghiberti (bronze), Donatello, Luca della Robbia (terra cotta), Mino da Fiesole, Verrocchio. In literature—Aretino, Poggio, Pulci, Savonarola, Poliziano, Pico della Mirandola, Lorenzo il Magnifico. In painting—Masolino, Masaccio, Fra Angelico, Uccello, the Bellini, the Lippi, Gozzoli, Pollaiuolo, Mantegna, Signorelli, Botticelli, Ghirlandajo.

Third Epoch: Culmination (1475-1525). In architecture—Bramante, San Gallo, Michelangelo, Sansovino. In sculpture—Michelangelo. In literature—Machiavelli, Ariosto. In painting—Perugino, Francia, Carpaccio, Pinturicchio, Leonardo da Vinci, Fra Bartolommeo, Michelangelo (form), Raffaele (sentiment), Giorgione and Titian (colour), Sodoma, Andrea del Sarti, l'Urbino.

Fourth Epoch: Decline (1525-75). In architecture—Palladio, Bernini. In sculpture—Bandinelli, Cellini (metals), Giovanni di Bologna. In literature—Bembo, Aretino, Tasso, and the men of the Leo X. era. In painting—Palma, Giulio Romano, Correggio, Moretto, Parmigiano, Bordone, Tintoretto, Paolo Veronese.

To exhaust the meaning of the Renaissance in a brief article is of course impossible; but one lesson so lies upon the surface and so gives the key to the whole movement that it may be stated in conclusion. It is this:—The mediæval new-birth of art, arising like Greek art in sculpture and architecture, followed curiously closely the same career. It had a first period of dawn; a second period of earnest striving after truth and beauty (Pheidias), at the close of which the search for the latter began at last fatally to eclipse that for the former; a third period of voluptuous perfection (Praxiteles), concluding by sinking into sensuousness and losing its religious or truth-seeking character; and a fourth period of mere mannerism, eclecticism, and decline. It is curious to see the intense refinement of intellect coupled with the rapid decline of the heroic type of character, and indeed of all true morality, in the epoch of Lorenzo, closing the second and opening the third epoch of the Renaissance. The men of those times, fully awake at last to the glories of classical antiquity, so long obscured, too often fell in love with surface aspects merely, and therefore made it only a question of time for the art to descend to mannerism; they worshipped the creature for itself instead of the Creator in the creature, and thus paved the way for a cynical depravity. The perception of their grievous mistake, and the resolve to aim at the true, the inner, and the only permanent meaning of things, led to the recent movement in art styled Pre-Raphaelitism, which has done so much to clear our modern air.

The best popular work on the Renaissance in English is Leader Scott's handsomely illustrated volume (1883);

more scholarly and learned works are the small book of Pater (1873), and the fine works of Symonds (three vols., 1875-77), and Burckhardt, English translation by Middlemore (1878).

RENSBURG, a very strongly fortified town of Germany, in Holstein, is situated partly on a heath, partly on an island at the mouth of the Eyder, and at its junction with Holstein Canal, 18 miles west of Kiel. It consists of three parts: the Old Town, built on the above-mentioned island; the New Town, on the Holstein bank of the river; and the Crown-work, with the last sluice of the canal, and some warehouses, all on the Schleswig side. Its inhabitants number 12,776. The town has some extensive fortifications, and contains two churches, an arsenal, military provision depot, and barracks; an hospital, a house of correction, a gymnasium, a military academy, a board of trade, a custom-house, numerous schools, and several houses of charity. The place has manufactures of stockings, pottery, tobacco, and vinegar, and a brisk trade in timber. It is a station on the Kiel and Altona Railway.

Rendsburg was taken by the Imperialists in 1627, by the Swedes in 1643, and by the Prussian and confederate troops in 1818.

RENÉ OF ANJOU (*Renatus*), born in 1409, succeeded his brother Louis III. as Duke of Anjou and Count of Provence, in 1434. After the death of Queen Joanna II. in 1435, René laid claim to the kingdom of Sicily and Naples, but he had a powerful rival in Alfonso of Aragon, who finally dispossessed him in 1442. In 1445 René gave his daughter Margaret in marriage to Henry VI. of England, on which occasion he obtained the restoration of his territories of Anjou and Maine, which had fallen into the possession of the English. René on the restoration of peace occupied himself with the arts, and wrote several works both in prose and verse; among others one on tournaments, the MS. of which, enriched with drawings, is preserved in the National Library at Paris. In 1449-50 he attended King Charles VII. of France in his successful war against the English. In 1478 Louis XI. of France seized Anjou under some pretence, and René retired to Aix in Provence, where he died in 1480. He introduced several useful trees and plants into Provence, among others the muscadine grape, and encouraged manufactures of woollens and glass. René was the last representative of the house of Anjou, and after his death Provence was united to France.

RENFREWSHIRE, anciently *Strathgruffe*, a county of Scotland, is bounded N. by Dumbartonshire, N.E. and E. by Lanarkshire, S. and S.W. by Ayrshire, and W. by the Frith of Clyde. It includes a small portion on the north bank of the Clyde. Its greatest length, south-east to north-west, is 31 miles; its greatest breadth, at right angles to the length, is 13 miles. The area is 253 square miles, or 162,427 acres. The population in 1881 was 263,374, of whom 126,743 were males and 136,631 females. This gives 1075 to the square mile.

Surface, Geology, Rivers, &c.—The western part of the county, and the southern border which joins Ayrshire, are hilly; the eastern part, especially along the Clyde, is comparatively flat. The hills on the border of Ayrshire are the loftiest; some of them attain a height of 1700 feet.

The south-eastern part is included in the great coal district of the west of Scotland. The chief coal works are at Quarrelton, near Johnstone, and at Hurler and Househill, near Paisley; the mines here are very productive. Limestone, sandstone, ironstone, granite, and secondary trap rocks are found in considerable abundance. Good freestone for building is quarried; limestone is also wrought for burning; and mines of coal and ironstone give employment to many persons.

Renfrewshire is included in the basin of the Clyde, the estuary of which washes a large portion of the border; but

the tributaries which drain it are of little importance. A stream which bears, in different parts of its course, the names of Rotten Burn, Shaws Burn, and Kipp Water, joins the Clyde estuary at Inverkip, on the western side of the county. The central and eastern parts are drained by the Gryffe, which flows from the westward; the Black Cart, which rises in Ayrshire, and unites with the Gryffe about 2 miles north-west from Paisley; and the White Cart, or the Cart, which rises near the eastern boundary, and passing through Paisley swells the united stream of the Black Cart and the Gryffe, just above its entrance into the Clyde near Renfrew. The White Cart is made navigable partly by an artificial cut to the Clyde. Although the other streams are not large enough for navigation, they supply water-power for driving machinery.

Soil and Agriculture.—The hilly parts of the county on the west and south are chiefly devoted to pasture. The cultivated part lies on the north and north-east, and in the centre, where the soil is most fertile. The uncultivated districts comprehend bleak moors or hills, with comparatively extensive bogs. Owing to the demand for meat, vegetables, milk, butter, &c., by the large and crowded populations of Glasgow, Greenock, and Paisley, a large portion of the cultivated land is occupied as meadow-land or market gardens, and everywhere agriculture is in a forward condition. Dry stone dykes in some parts of the county serve as fences, but where the soil is better and more under cultivation, hedges are used. Farms are middle-sized, and farm-houses and buildings are generally of a substantial and improved character.

The county is well supplied with railways, and has some important manufactures of cottons, tartan stuffs, checks, shawls, and flannels for shirts. There are also several collieries, and small quantities of copper ore are obtained. Limestone and freestone are very abundant.

Renfrewshire contains fifteen parishes. It returns two members to Parliament. Paisley and Greenock send one member each.

History and Antiquities.—In the earliest historical period this county seems to have formed part of the territory of the Damnii, who occupied portions of the adjacent counties of Ayr, Lanark, Stirling, and Dumbarton. Under the Romans it was comprehended in the province of Valentia. It appears to have been subsequently included in the British Kingdom of Strathclyde, and afterwards in the kingdom of Scotland. A large part of it came into the hands of the Stewards of Scotland, progenitors of the Stuart family, by grant from Robert III., especially Strathgryffe, or the valley of the Gryffe (1404). In a later period Renfrewshire made part of the principality formed out of the Stuart domains as an appanage for the eldest son of the kings of Scotland.

There are some ancient camps in Renfrewshire; and some antiquities, supposed to be Druidical, exist in the parishes of Kilbarchan and Lochwinnoch, but they are of little moment. Barr Castle and Elliston Castle, both in Lochwinnoch parish, Peel Castle on Castle Semple Loch, and Newark Castle, near Port-Glasgow, are of mediæval character.

RENFREW, the shire town of the above county, and a burgh of barony, is 3 miles north-east by north from Paisley, by the Paisley and Renfrew Railway, and 406 from London. The town is near the south bank of the Clyde, and consists of one main street along the Glasgow and Greenock road, and some smaller ones. The town-hall, injured by fire in 1878, has been renovated, and has a square tower 105 feet high. There is an atheneum with a public library. The parish church has a spire about 180 feet high, and there are Free, United Presbyterian, and Roman Catholic churches. The school-house was originally endowed by King Robert III. Silks and muslins are woven, and many females are employed in clipping,

tambouring, and flowering. The town also contains starch works, a distillery, bleachfields, and ironworks, and some yards for building iron vessels. A considerable number of ships, chiefly laden with grain from Ireland, or with dyestuffs for Paisley, discharge their cargoes here; and in 1884 the harbour was considerably improved, so as to provide 6 feet of water at low tide and 16 at high water. Fish is brought from the Highlands.

The corporation consists of a provost, two bailies, a dean of guild, a treasurer, and seven councillors. Renfrew is connected with Kilmarnock, Rutherglen, Dumbarton, and Port-Glasgow in returning a member to Parliament. The population of the burgh in 1881 was 4825. It was extended in 1885 and the number increased to 5503. The royal family of Stuart, so called from their office, had their original residence near this town; hence the title of Baron Renfrew, borne by the Prince of Wales.

RE'NI, GUIDO. See GUIDO.

RENNES, capital of the French department of Ille-et-Vilaine, stands on the Ille-et-Rance Canal, at the confluence of the Ille and the Vilaine, and had, in 1881, 60,974 inhabitants. The town occupies the site of the ancient *Condate*, the chief city of the Celtic Redones, whose name it subsequently took and still bears with slight alteration. On the downfall of the Roman power the Bretons seized Rennes, and formed under their dukes a kind of independent state. In the anarchy which prevailed in Brittany towards the close of the ninth century it became the capital of a county till 992, when Count Geoffroi of Rennes assumed the title of Duke of Brittany, after which event it became again the capital of all Brittany. In the struggle between De Montfort and De Blois, Rennes, then held by the partisans of De Blois, was besieged for six months by John of Gaunt, duke of Lancaster, but he was obliged to raise the siege. Before the Revolution the states of Bretagne met at Rennes, and it was the seat of a *parlement* instituted in 1555, by Henry II. In 1720 the town was laid waste by fire, which destroyed the whole of the quarter on the right bank of the Vilaine. It has produced numerous distinguished men, among whom may be specified the famous Constable Duguesclin, born in the Castle of Motte-Broom, in the immediate vicinity, in 1314.

The present city, owing to its pretty situation and the gentle undulation of its site, has an agreeable appearance, especially the new town, which is distinguished by wide, regular, and straight streets, handsome squares, and good buildings, constructed of granite. Rennes is surrounded by an ancient wall and towers. The upper or new town, and the lower town, which stands on the left bank of the Vilaine, are united by three bridges. The latter has narrow and crooked streets, with houses mostly built of wood, curiously carved and highly picturesque. The suburbs, which are large, resemble the lower town in character. Rennes is noted for its fine public walks, the principal of which are—Le Thabor, formed out of the gardens of the old Benedictine abbey; the Mail, which is formed by a long jetty that runs between two canals to the junction of the Ille and the Vilaine; and the Champs-de-Mars, a space of 125 acres, inclosed by raised and shady walks.

The most remarkable of the public buildings are the cathedral, the churches of St. Pierre, Toussaint, and St. Sauveur; the town-house, an elegant structure in which are the mayor's offices, a public assembly room, the public library, lecture-rooms, and schools of design and architecture; the court-house, which is appropriated to the administration of justice and to the study of the law, and is decorated with paintings; the episcopal palace; the abbey of St. Georges, now occupied as a barrack; the Kergus barracks, and the arsenal.

The manufactures comprehend linen, sailcloth, flannels, hosiery, lace, cordage, nets, hats, gloves, starch, glue, earthenware, porcelain, candles, and liqueurs. There are

tan-yards and wax-bleaching works. A considerable trade is carried on in these articles, and in the honey, wax, poultry, and butter of the surrounding district. The Vilaine is navigated by barges up to the town. [See ILLUSTRATION.] The Ille-et-Rance Canal communicates with St. Malo, and a line of railway with Paris (186 miles W.N.W.), Nantes (61 miles S.W.), &c.

Rennes gives title to an archbishop. It is the seat of a High Court and University Academy. The other institutions of the town comprise civil and commercial tribunals, a council of prud'hommes, chambers of commerce and agriculture, a Catholic college, and schools of artillery, law, medicine, design, sculpture, and agriculture; a national college, provincial normal school, two museums, a library containing 50,000 volumes, public baths, a botanical garden, society of science and arts, four hospitals, a theatre, a house of correction, &c.

RENNIE, JOHN, a celebrated civil engineer, was born on 7th June, 1761, at Phantassie in Haddingtonshire, where his father was a farmer. He received instruction in the elementary part of mathematics at Dunbar, and on the promotion of the master for a short time conducted the school. He appears to have very early devoted his attention to the subjects of machinery and architecture.

About 1780 he left his native place and shortly afterwards established himself as a mechanist in London, where he obtained immediate employment. From this period he continued to be occupied in the construction of steam-engines, or of the different kinds of machinery to which, as a first mover, steam is applied; and at the same time he was almost constantly engaged in designing or superintending those public works which have given him so just a claim to celebrity. Between 1799 and 1803 he constructed the stone bridge at Kelso, below the junction of the Tweed and Teviot. He also built stone bridges at Musselburgh and other places in Scotland, but his masterpiece of this kind is the Waterloo Bridge over the Thames. The Southwark Bridge over the same river is an iron bridge, and was also constructed by him.

Mr. Rennie superintended the formation of several canals; and his chief work in connection with inland navigation is the Kennet and Avon Canal, which extends from Bath to Newbury. He also gave a plan for draining the fens at Witham in Lincolnshire, which was executed in 1812.

The London Docks and the East and West India Docks at Blackwall are among the great works which were executed from his plans and under his direction. He formed the new docks at Hull (where also he constructed the first dredging machine used in this country), the Prince's Dock at Liverpool, and those of Dublin, Greenock, and Leith. To these must be added the breakwater protecting Plymouth Sound from the waves which, during high winds, used to roll in with tremendous force. He also devised plans for improving the harbours of Berwick, Newhaven, and other places, and the dockyards of Portsmouth, Plymouth, Pembroke, and Chatham.

Before his death he had prepared a scheme for improving the docks at Sheerness, which was afterwards carried out by his sons, to one of whom (Sir John Rennie) was also confided the charge of the construction of the present London Bridge, from the designs of his father. Mr. Rennie died of an inflammation of the liver, 16th October, 1821, and was buried in St. Paul's Cathedral.

RENT. In popular language the term rent is usually applied to whatever is annually paid by a farmer or householder to his landlord, but in political economy it has a more limited meaning. Ricardo defined it to be "that portion of the produce of the earth which is paid to the landlord for the use of the original and indestructible powers of the soil." This definition has been modified by later writers, who are, however, in substantial agreement

with Ricardo as to the law of rent. Mill, for example, includes under the term rent the return made to capital spent once for all in giving the land a permanent increase of productiveness, as in the Bedford Level, on the ground that equally fertile land commands the same rent, other things being equal, whether its fertility is natural or acquired. Professor Cairnes, in his "Character and Logical Method of Political Economy" (1875), defines rent still more broadly as the "permanent surplus value," in certain branches of industry, "beyond what is sufficient to replace the capital employed in production, together with the usual profits which happen to prevail in the country." One of the most recent English writers on the subject, Professor Sidgwick ("Principles of Political Economy," 1883), while admitting that "land in England of any quality above the lowest is at a scarcity value, so that a portion of the rent paid for it is undoubtedly due, not to the labour spent in fitting it for Agricultural uses, but to the appropriation of the raw material to which such labour has been applied," urges that it is "misleading to say that this portion is a price paid for the 'original and indestructible' qualities of the soil; since, so far as it depends on situation, it is plainly due, not to the original qualities of the land, but to the development of the human community inhabiting it, and the manner in which this community has disposed itself over the surface of the country." This element of rent is now generally known by Mill's name for it—the unearned increment. Professor Sidgwick declines to follow Mill in "separating from agricultural rent whatever part of the price paid for the use of the farm is interest on the recurrent expenditure on buildings, fences, &c., necessary to maintain the fitness of the farm for agricultural uses. . . . The owner of the farm cannot avoid spending it unless he wishes to sacrifice a large part of the value of his land; the yield of this capital therefore does not vary—as Mill seems to suggest—with the current rate of interest; and there seems no adequate reason for separating it from the yield of the land in which the capital is invested, when we are considering the laws determining normal rent and interest at any given time." The definition of rent which is probably least open to criticism and, at the same time, most nearly corresponds to the ordinary significance of the word, is that given by Professor Sidgwick himself in the work just quoted:—"The normal rent per acre of any piece is the surplus of the value of its produce over the value of the net produce per acre of the least advantageous land that is profitable to cultivate, provided the amount of capital employed is the same in both cases."

Several theories have at different times been advanced in explanation of rent. The great French economists of the eighteenth century traced it to the superior productiveness of agricultural as compared with every other form of industry. Nature, they said, co-operates here with human effort, and there consequently arises in agriculture a *produit net*, or rent, which has no place in other fields of human industry. But apart from other serious objections to this theory, it ignores the question of price, on which mainly depends the production of surplus value, and therefore fails to solve the problem of rent. Adam Smith himself added little or nothing to the elucidation of this subject, and indeed fell into the serious error of supposing that rent ordinarily enters into the price of agricultural produce. This can only happen, as Professor Cairnes has pointed out, under a monopoly of land by the government, or by a combination of owners. There are instances of rents paid in new countries, as in Australia, while yet all even of the best lands were not taken up, in consequence of all the available land being held by the government, which was thus enabled to fix a monopoly price. In such a case "the price of corn rises because the government demands a rent. In the ordinary case the landlord demands a rent because the price of corn is high."

The true theory of rent was first laid down by Dr. Anderson, a Scotch writer, in a work published barely a year later than Smith's "Wealth of Nations," but it failed to attract attention. Nearly forty years later it was almost simultaneously rediscovered by Sir Edward West, Malthus, and Ricardo. And, as Professor Walker observes, "the cogency with which the arguments of the last-named were put, and the stringency with which the principle involved was applied, . . . have served to affix his name permanently to the doctrine, alike in England, in America, and on the continent of Europe."

Probably the best concise statement of the Ricardian law of rent is the following by the above-quoted Professor F. A. Walker, of Boston ("Land and its Rent," London, 1883)—"Rent arises from the fact of varying degrees of productiveness in the lands actually contributing to the supply of the same market, the least productive land paying no rent, or a rent so small that it may be treated as none. The rent of all the higher grades of land is measured upwards from this line, the rent of each piece absorbing all the excess of produce above that of the no-rent land." In the above phrase, "varying degrees of productiveness," is included, not only the difference in the fertility of the land, but any other causes, such as distance from, or difficulty of access to, the market by which the net productiveness of a tract of land for the purposes of rent may be reduced in comparison with another tract of equal fertility. The law of rent thus stated requires but little demonstration. If the demand for agricultural produce, as shown by the price obtainable, be such as to make it worth while to cultivate soils of low productiveness, on which therefore the crop is raised at the highest cost, all land on which the cost of production is less must yield a surplus value which, in proportion as competition is free, falls to the landlord, and constitutes normal or economic rent. It is evident that this rent must increase as cultivation is forced down to inferior soils under the pressure of demand and consequent increase of price. On the other hand, anything which tends to equalize the productiveness of the different tracts of land supplying the same market, either by cheapening carriage or improving agriculture, tends to reduce rent. The recent decline of rent in England under the competition from different parts of the world, which improved means of communication have brought into play, is a case in point.

A common objection to the law of rent is that it presupposes the existence of no-rent lands, while in a country like England there are none. This is, however, not correct. Many farms include what are practically no-rent pieces of land, although in letting an average rent is charged for the whole—taking the bad with the good. There are other tracts, too, which are incapable of yielding an agricultural rent, and therefore for the purposes of the present discussion no-rent lands, although they are let for sporting or similar purposes.

Although the Ricardian law of rent has been fully accepted by the principal economists, both English and foreign, it has met with much opposition and misunderstanding. Its principal opponents have been H. C. Carey, an American economist ("Political Economy," Philadelphia, 1837; "The Past, Present, and Future," 1848, &c.), who declared that it was "universally false," and maintained that "there is not throughout the United States a country, township, town, or city that would sell for cost, or one whose rents are equal to the interest upon the labour and capital expended," and therefore he contended there is no such thing as economic rent—i.e. rent proper as distinguished from interest. But, as Professor Walker conclusively shows in his "Land and its Rent," already quoted, this argument proves too much. "If so much has been lost, why not more? And if more, why may not Ricardo's first element (rent proper) enter after all?" Our space will not permit

us to enter into an examination of Carey's views, nor of those of the eloquent French economist, F. Bastiat, who, in his "Harmonies Économiques" (Paris, 1850), denies the Ricardian law, and endeavours to establish a wholly independent basis for rent which shall make its payment consist with his glowing theory of the mutuality of services. The arguments of both these writers will be found fully discussed and refuted by Professor Walker in the work above referred to.

Economic rent, as above described, must not be supposed to be necessarily and always exacted. It represents the share which the landlord is able to obtain under free competition, although as a matter of fact "the United States and Ireland," as Professor Walker observes, "are probably the only two considerable countries in which rents closely approximating to true competitive rents have been habitually paid." In England the relations between landlord and tenant, and the state of public opinion, are generally such as to prevent the exaction of the full competitive rent, and on the continent of Europe a similar state of things exists. Indeed, Sir Henry Maine, in his "Village Communities," asserts that "it is all but certain that the idea of taking the highest obtainable rent for land is relatively of very modern origin. The rent of lands corresponds to the price of goods; but doubtless was infinitely slower in corresponding to economic law, since the impression of a brotherhood in the ownership of land still survived, when goods had long since become the subject of individual property."

RENTES, the name of the French funds; also used for the Italian, Austrian, Spanish, and Hungarian funds. The word is from the Ital. *rendita*, Lat. *reditus*, a return; hence, an interest.

The rentes of France and Italy differ from our own consols in the fundamental conception of the obligation. Our consols represent a capital sum bearing interest; for instance, £100 consolidated 3 per cent. bond of England will have the amount of the capital printed upon it, and the amount of the interest (£1 10s. 6d.) printed upon each half yearly coupon. Not so the French or Italian rente. This represents no capital sum at all, but merely the obligation to pay so many francs of rente or interest yearly. Thus, the certificate of 100 francs rente does not represent a nominal capital of 3300 francs or any other sum; nothing but the yearly rente of 100 francs, or the half-yearly rente of 50 francs, if the coupons are payable half-yearly, is to be found expressed upon it. Hence the correctness of the respective designations "funds" and "rentes." Spanish and Hungarian rentes, however, follow the English method, and express the imaginary capital.

Nevertheless, it is found convenient to class French rentes as 3 per cent. rentes, 5 per cent. rentes, &c., notwithstanding that no capital is truly represented by them. And after all the distinction is chiefly in words; because the English fundholder, though he is credited with a certain capital sum, can no more demand repayment of it than can the French *rentier*; and, indeed, the reader will probably have observed that official documents always carefully speak of "bank annuities," never of "funds" or "consols."

REPLEVIN. The only form of replevin now in use is replevin of goods, called in the old statutes *Replegiari de Averis*, cattle (in Law Latin, *averia*) being the species of goods which usually formed the subject of a distress.

If the goods of a party were taken out of his possession against his will, he was entitled at common law to sue out a writ of *Replegiari Facias*, by which the sheriff of the county in which the goods were taken, or of the county in which they were detained, was required to cause the goods to be replevied, i.e. restored to the owner upon his giving pledges for the prosecution of his action, and also by statute pledges for the return of the goods to the distrainor in case a return should be adjudged. As the right of the party from whom the goods are taken to have the possession

restored to him by replevin depends upon the property belonging to him, if the taker of the goods claim them as his own property, the power of the sheriff is suspended until the party has sued out a writ *De Proprietate Probanda*, by which the sheriff is directed to summon a jury for the purpose of trying whether the goods are the property of the plaintiff or of the defendant; and if they are found to be the property of the plaintiff, then to replevy them; if of the defendant, the plaintiff's claim to be restored to the possession of the goods remains in suspense until the termination of the action. A special action lies at the suit of the crown and the party aggrieved, for falsely claiming property in the goods distrained, and thereby preventing a replevin.

REPORTING, PARLIAMENTARY. The history of Parliamentary reporting embraces one of those questions of great constitutional importance raised by WILKES in his contests with the House of Commons, and which he brought to a successful issue on behalf of popular liberties.

In 1641 the Long Parliament permitted the publication of its proceedings, which appeared under the title of "Diurnal Occurrences in Parliament." The printing of speeches, however, without leave of the House, was prohibited, and this prohibition was continued after the Restoration. Notwithstanding this debates were frequently published, especially when it served the purpose of active politicians like the first Earl Shaftesbury that they should be so. Andrew Marvell, the poet, reported the proceedings of the Commons to his constituents at Hull from 1660 to 1678. Innumerable attempts were made by the House to restrain the "news-letter writers," who were the reporters of the day, from publishing its proceedings, but they were ineffectual. At the end of the reign of Queen Anne reports were issued monthly by Boyer in his "Political State." These were followed by reports in the *London Magazine* and *Gentleman's Magazine*, the authors of which were frequently assisted with notes from members of Parliament. For three years (1711-43) Dr. Johnson wrote the reports for the *Gentleman's Magazine*. How these reports were compiled may be gathered from the fact that he had nothing communicated to him but the names of the several speakers and the part which they had taken in the debates, and he told Boswell that he was only once in the House of Commons during these years. When, on one occasion, some ladies and gentlemen were lost in admiration over one of Pitt's most eloquent speeches, Johnson astonished the company by exclaiming, "That speech I wrote in a garret in Exeter Street." One lady remarking that he had dealt out reason and eloquence with an equal hand to both parties, he replied, "That is not quite true; I saved appearances tolerably well, but I took care that the Whig dogs should not have the best of it." With meaner men than Johnson we may conceive that there was no attempt to save appearances, and it was this constant misrepresentation and unfairness which excited the rage of members, and so often brought the House into conflict with the printers. It became necessary to disguise the reports, and in the *Gentleman's Magazine* the debates were assigned to "The Senate of Great Lilliput," and in the *London Magazine* to the "Political Club," where the speeches were attributed to Mark Antony, Brutus, and others. Finally, in 1771, at the instigation of Wilkes, notes of the speeches, with the names of the speakers, were published in several journals. The personalities freely interspersed through the descriptions were not calculated to conciliate. One member was called "the scoundrel," and another "the little insignificant insect." The long struggle into which the House entered with the printers, who were supported by the lord mayor and Alderman Wilkes, ended in the triumph of the latter, and debates were thenceforth published with impunity. Not, however, till much later was a gallery provided and the reports recognized as part

of the regular working of the House. At length the managers of the *Morning Chronicle* established a staff of reporters, and Hansard undertook the publication of reports for the benefit of the House. From 1803 to our own day volume after volume of Hansard's "Parliamentary Debates" have appeared, which give the fullest reports of the debates. Previously there had been issued thirty-two volumes of Cobbett's "Parliamentary History," and these, in conjunction with "Hansard," form a valuable record of our national history. For many years only the London papers had places in the reporters' gallery. Seats were afterwards provided for the news agencies—such as the Press Association and Central News—which supply reports to the provincial papers; and now the *Scotsman*, the *Leeds Mercury*, and other great provincial journals have their own staff of reporters in the House, and a special wire from London to their offices. It will be thus seen that every facility is now offered by the House to journalism. The *Times* has three boxes in the reporters' gallery; most of the leading newspapers have two, and rooms are provided where the reporters can transcribe their notes.

REPORTS, in law, are relations of the proceedings of the queen's courts of justice. They contain a statement of the pleadings, the facts, the arguments of counsel, and the judgment of the court in each case reported. The object of them is to establish the law, and prevent conflicting decisions, by preserving and publishing the judgment of the court, and the grounds upon which it decided the question of law arising in the case.

The earliest reports extant are the "Year-Books," which commence (and are now printed) at the reign of Edward II., with occasional interruptions, and continue down to the reign of Henry VIII. The "Year-Books" are wholly written in Norman-French, although by 36 Edw. III. stat. 1, c. 15, it was enacted that all pleadings should be in the English language, and the entries on the rolls in Latin. The Norman-French continued to be used by some reporters even as late as the eighteenth century. The place of the "Year-Books" was supplied by reports compiled and published by private individuals on their own responsibility, but subject for some time to the inspection and approbation of the judges, whose testimony to the ability and fitness of the reporter is often prefixed to the reports. This, however, in course of time became a mere form, as appears by the statement of Lord-keeper North, who speaks slightly of the reports in his time as compared with his favourite "Year-Books."

• The English language was first used by reporters about the time of Elizabeth. Lord Coke employed it in his "Commentary upon Lyttleton." From the period of Elizabeth down to the present, reports have been published of the proceedings in all the courts. The whole body of reports is now very large. Every court has its reporters, who are not persons authorized by the courts. They formerly used their own judgment as to what they should report, and their volumes often contained trifling matters, and were swelled out to a most unreasonable and useless bulk. A good record of cases decided, with a brief statement of the cases and the grounds of the decision, is useful and necessary; but the great mass of reported cases and the trifling matter of many of them once had the effect of making lawyers rely more on the judgments in particular cases than on those general principles of law which have an extensive application, and are the surest foundation for a sound legal opinion. To remedy this, in 1866, "The Law Reports" were commenced, and are now issued by the council of law reporters, which is composed of the leading counsel of the day. In Scotland the reports were for many years conducted under a committee of the Faculty of Advocates, and therefore named the "Faculty Collection." For several years reports have been published by individual enterprise.

REPRESENTATION (of the people in Parliament). See REFORM ACTS AND PARLIAMENT.

REPRIVE (from the French *reprise*, withdrawn) means the withdrawal of a prisoner from the execution and proceeding of the law for a certain time. Every court which has power to award execution has also power, either before or after judgment, to grant a reprieve. The consequence of a reprieve is, that the delivery or the execution of the sentence of the court is suspended. A reprieve may proceed from the mere pleasure of the crown expressed to the court, or from the discretion of the court itself.

There are two cases in which a reprieve is always granted. One is where a woman who has been capitally convicted pleads her pregnancy in delay of execution. The other is where a prisoner appears to have become insane between judgment and the award of execution. A jury must then be sworn to inquire whether he really is insane.

REPRODUCTION naturally divides itself into the two main branches of *Reproduction of Animals*, and *Reproduction of Plants*.

REPRODUCTION OF ANIMALS may be divided into two broad fields, *asexual* (i.e. not sexual) and *sexual*.

Asexual reproduction is the only type of generation observed in the lowest forms of animals, the Protozoa. Here there is no male nor female; each animal is complete in itself, and multiplies by simple *fission*. The body divides into two or more parts, and each of these quickly assumes the mature shape, and in its turn propagates its kind in the same way. An example of fission in higher forms of life is shown in Annelida. When only a small part is thrown off, as if it were a bud, the process is called *gemmation* (Lat. *gemma*, a bud), and the most familiar examples of this are the polyps (Hydrozoa). As we ascend in the scale of nature sexual reproduction occurs; that is, we find a germ which is inert until it is fructified by some other special substance, usually provided by a separate parent. Even in the lower Metazoa the sexual type predominates over the asexual, and this predominance increases, until in the highest forms the sexual type alone is found. But it would be wrong to imagine that any direct line can be drawn where the one type is replaced by the other, so that we could class the inferior forms as asexual, the superior as sexual. On the contrary, the division line is very undefined, and the two types occur together for long spaces in the scale of beings. All we can say is that the very lowest animals are asexual, and the very highest sexual; and that in the large middle region, when both types occur, the sexual is to be held a mark of superiority to the asexual. There are cases, as among the Ascidians, where asexual reproduction occurs by degeneration.

Sexual Reproduction.—In some cases, both sexual elements are contained in one individual, as with plants; this is termed *conjugation*, and in its simplest form consists of two like masses of protoplasmic matter, whose union forms the basis for the new organism. The perfect type, however, is a germ contained in an ovum (or egg), and produced by the female, which is fertilized by spermatozoa contained in a seminal fluid produced by the male. The lowest forms of sexually reproducing animals produce the characteristic elements and leave them to chance, but in higher forms great care is taken to bring the two elements securely together and insure the fertilization of the ovum. We can all see how gay the plumage of the male bird is and hear how brilliant his song, at pairing-time; and among ourselves, both sexes on arriving at maturity obtain their greatest physical beauty—the woman her exquisitely rounded flowing outlines of form, wealth of hair, and grace of movement and expression, the man his stalwart strength, his broad shoulders and deep chest, his beard, his grave and resonant voice, and his courage for all undertakings. These attributes are so attractive, each to the opposite sex

that they create mutual likings and lead to unions at the most suitable time for nature's purposes. Either earlier or later than this period, neither sex is so attractive in the merely animal way in which we are now considering the race.

The spermatozoa of the male seminal fluid may be produced by certain organs (testes), and when so produced may either be set free or delivered by a particular excretory apparatus; or they may be produced by mere segmentation of some of the ordinary cells making up the body of the animal, without any reproductive organ at all, a case which occurs in the sponges. (The sponges also use at other times asexual gemmative reproduction.) In these lowly forms also the female side of the function, the production of ova, is attained by an ordinary cell differentiating itself into an ovum; but higher animals have special ovaries for their production, and cavities (uterus) for their preservation and for the reception of the seminal fluid. Again, in some forms—as oysters, for example—each individual is alternately male and female; but it is not capable of self-fertilization, since at any given time it is either producing spermatozoa or ova, and at no given time is producing the two together. In fact it seems to be increasingly probable, in all cases of so-called hermaphroditism, even when both sexes are in one individual, that two individuals are required for mutual fertilization, and that each one is sterile to itself. The details of the various organs of generation are too voluminous to be given here, while the subject is not suitable for a merely general treatment. Many animals have no copulatory organs at all, but the females void their ova, and the males void the milt or seminal fluid upon them, an arrangement common to most fishes. Other animals use ordinary members for the special purposes of reproduction—as spiders, for example, where the seminal fluid is passed into the maxillary palpi or chelæ (claws), which become enlarged for that purpose, and transfer the fluid to the female by contact.

The bee presents a very curious special case. At a certain period of the year the queen bee, the only fertile female in the hive, takes flight, and is impregnated by the drones (males) in the air. It is immaterial, apparently, whether one or more impregnations occur. The first remarkable thing is this—the seminal fluid is received in a receptacle closed at will. As the ova pass down from the ovary the queen fertilizes them to make new queens, half-fertilizes them to make sterile workers, or lets them pass unfertilized, in which case only drones or males are produced, opening or closing the receptacle for these purposes. If this receptacle be removed or the connection cut off, it is found by experiment that the queen bee produces nothing but males. The second extraordinary fact is, that the queen may go on laying fertile eggs for three years after impregnation, almost suggesting that the spermatozoa have some sustaining or possibly reproductive power within her body. The third point is the clear case of birth from an unfertilized ovum, which is presented in the drones—a mode of reproduction called **PARTHENOGENESIS**.

Birth varies very greatly. The Invertebrata are nearly all oviparous; that is, the development of the ovum occurs after leaving the parent. Insects, however, show a certain degree of viviparous development; namely, that called *ovoviviparity*, where the eggs are hatched within the parent's body. Of the vertebrates, fishes, mostly oviparous, have nevertheless many exceptions to this rule. Sharks and dog-fishes are viviparous, for example. Birds and reptiles are oviparous, with few exceptions. Mammals are viviparous, the two exceptions being the curiously bird-like Ornithorhynchus and the Echinida, both of which lay eggs. But the young of viviparous animals are by no means equally developed at birth. Contrast the ability to provide for themselves which lambs or calves or chickens show, with the blind state of puppies or kittens; or these with the utterly dependent state of

the human infant, and its parallel in the curious half-developed young of the marsupials, transferred to the large pouch (*marsupium*) of the mother in their scarcely living condition, and there nourished, being not able yet to suck, by the action of special mammary muscles, which force the milk into their mouths. (When they can shift for themselves a little they leap out of the marsupium and return at their pleasure.)

Von Baer, in 1828, gave renewed interest to the study of reproduction in the embryonic stage by his startling hypothesis, now almost universally admitted as a fact, that the embryos of a higher animal pass through lower forms, a discovery which Haeckel put into the fine phrase, "*Ontology* (development of the individual in the present) is an epitome of *phylogeny*" (development of the race in the world's long history). Professor Parker ("Morphology of the Skull," 1877) has beautifully put the biogenetic law in his remarks on the development of the skull in the ordinary chicken:

"Whilst at work I seemed to myself to have been endeavouring to decipher a palimpsest, and that not erased and written upon again just once, but five or six times over.

"Having erased, as it were, the characters of the culminating type—those of the gaudy Indian bird—I seemed to be among the sombre grouse, and then, towards incubation, the characters of the sand-grouse and benipod stood out before me. Rubbing these away in my downward walk, the form of the tinamou looked me in the face; then the aberrant ostrich seemed to be described in large archaic characters. A little while and these faded into what could just be read off as pertaining to the sea turtle; whilst underlying the whole, the fish, in its simplest myxinoïd form, could be traced in morphological hieroglyphics."

The development of the ovum is treated of in the article DEVELOPMENT, and the history of the embryo, especially that of man, traced in EMBRYOLOGY.

The chief works on the subject are Haeckel's "General Morphology" (1886); Balfour's "Comparative Embryology" (1882); Gegenbaur's "Comparative Anatomy" (English translation, 1882); Semper's "Progenital System of Plagiostomes" (German, not yet translated), and a clever paper by Geddes and Thomson on "History of Spermatogenesis" (Papers Royal Soc., Edin., 1886).

REPRODUCTION OF PLANTS.—There is a plant, found in Great Britain, which is known from its peculiar underground stem as Coral-wort (*Dentaria bulbifera*). It may be taken here as an example in explaining reproduction. The coral-wort, like other flowering plants, normally produces seeds, and each seed is capable of germinating and growing up into a plant which is a likeness of its parent. This is one mode of reproduction. However, from some cause, perhaps lowness of temperature, coral-wort seldom produces seed in this country, and yet there are always numerous plants in the spots where it is found. On examination it is found that in the axils of the leaves there are small fleshy bodies which, on attaining a certain size, fall away and grow up into new plants. These buds, modified to contain a large supply of nutritive materials, are called *bulbils*. The rhizome or underground stem is also fitted to produce shoots, which form independent plants when the parent rhizome has died away. Again, if cuttings are made from the stem, new plants will be formed. The potato is another example of a modified underground stem budding into new plants, and in this case the plant is propagated altogether in this way, and not by seed. The bulbs of lilies and the corms of crocuses afford other examples. The leaves of Begonia (*Bryophyllum calycinum*) and many ferns are capable of giving rise to independent plants. It thus appears that almost any part of a plant can reproduce the parent. On the other hand, it is always one particular cell which produces the seed. This mode of reproduction from a specialized cell is known as true reproduction,

whereas the other modes are vegetative reproduction, or vegetative multiplication.

The seed is a complicated structure only found in flowering plants, and in order to get some insight into the process of reproduction, it is necessary to begin at the other end of the scale with the lowest plants. The single specialized cell, which in true reproduction is the origin of the new individual, is called a "spore." It is a mass of protoplasm, generally inclosed in a cell-wall, with a nucleus, and containing starch or oil as material with which to start growth. Nostoc is a very simple Alga, consisting of rows of single cells, several rows being inclosed in a jelly-like mass. A spore is formed in the simplest way by a cell becoming slightly enlarged and surrounded with a thicker wall. In *Protoecoccus* a cell divides into two, four, or numerous spores, and as these are motile, they are called "zoospores." The zoospores are relatively large or small, the larger being called macro-zoospores, and the smaller micro-zoospores. After a period of active life each settles down, and after a time of rest form new *Protoecoci*. *Ulothrix*, like *Protoecoccus*, forms macrospores and microspores, which germinate in the same way, but sometimes two of the microspores, very shortly after leaving the mother-cell, unite and form a single cell, which afterwards germinates. Here, in the union of two distinct cells, we have the first trace of sexual reproduction, and it is remarkable that it can occur in the same plant as asexual reproduction. It is found convenient to have a special term, "gametes," for the cells which unite, and another, "zygospore," for the result of union of two similar gametes. *Scytosiphon lomentarius* presents a new feature. It also has zoospores, some of which are macrospores and others microspores. Some of the latter germinate without union (asexual reproduction), others while moving meet and fuse. But sometimes one of these zoospores attaches itself by one of its two cilia to some support, absorbing the other. While at rest in this way another zoospore in active movement unites with it, and this is a first indication of the active male and the passive female gamete. We trace this same development of sexual cells in the Conjugata. In one group, the Mesocarpææ, the cell-walls of two cells in adjacent threads grow out to meet one another; the walls at the point of union are absorbed, and a zygospore is formed between the threads. But in *Spirogyra* and other Zygnemææ the protoplasm of one cell passes over completely into the corresponding cell; the former therefore must be considered the male, and the latter the female. *Zanardinia collaris*, a brown marine Alga attached to rocks, presents a further stage in having male and female gametes developed in distinct and different sexual organs. On the upper face there are hairs, some smaller than the others. The terminal cell of each of the larger divides into several cells, each of which produces a female gamete; these escape one by one at the apex of the thread, swim freely by means of two cilia, and finally come to rest. In the same way the smaller threads divide into more numerous cells, each of which produces two motile male gametes. They unite in the same manner as in *Scytosiphon*. It is to be remarked that these zoospores are incapable of germination without sexual union, though asexual reproduction is provided for by zoospores formed in special sporangia. In the Bladder-wrack (*Fucus*) there is a still greater difference between the sexual cells; the female sexual organ (oogonium) produces eight cells (oospheres), which are very large as compared with the very numerous male cells (antherozoids) produced in the antheridium. The oosphere has no cilia, while the antherozoids are quite like the ciliated gametes already considered. The union of these cells, which differ so much from one another, is known as fertilization. The reproduction of *Vaucheria* is similar, but there is only one oosphere in each oogonium, and it is not set free. We will not consider here reproduction in the Fungi,

which are saprophytic or parasitic, and exhibit degeneration or total loss of sexual reproduction. In Muscineæ and the vascular cryptogams the female organ is termed the archegonium, differing only from the oogonium of the thallophytes in being multicellular. In flowering plants, the archegonia and antheridia are so greatly modified that they are known by different names. The male organ is the pollen-tube, which consists of one cell, and effects fertilization by growth to the female organ. In gymnosperms, the microspores are the grains of pollen; these, like the higher cryptogams, give rise to a prothallium, which is quite rudimentary (analogous to that of *Isotetes*), consisting of a small sterile cell, and a larger one which elongates into the pollen-tube. Again, the macrosporangium—the nucleus of the ovule—produces the embryo-sac, the mother-cell of the macrospores. The embryo-sac does not give rise to macrospores, but directly to a prothallium, the endosperm, which fills the whole sac, and in this arise the archegonia or corpuscula with stigmatic cells, canal cell, and oosphere. The latter produces the embryo. In angiosperms the division of the pollen is only protoplasmic, and does not last long. The prothallium of the embryo sac is reduced to six cells, three at the upper end of the sac and three at the base; the lower one of the upper three is the oosphere.

The importance to the plant of true reproduction (i.e. by means of spores) lies in the fact that spores or seeds in flowering plants are capable of resisting exposure to extremes of temperature or want of food. Moreover, they are light, easily dispersed, and therefore provide for the extension of the species to places where they will not interfere with the parents. The value of the sexual process appears to be that without it the individuals in a long series of generations become degenerate, inheriting rather the weak points of their ancestors, whereas the result of a cross is to induce a return to the vigor possessed by the common ancestor. Darwin's work on "Cross-fertilization" is a valuable contribution to the subject.

REPTILES (Reptilia) is one of the great classes into which the subkingdom VERTEBRATA is divided. From the time of Aristotle down to the beginning of the present century, the term reptiles included not only serpents, lizards, crocodiles, and tortoises, but also the frogs and newts. In the present century, however, the broad difference separating these two latter animals from the others have been more and more recognized by naturalists, so that now they and their allies are separated entirely from the reptiles, and constitute a distinct class, Amphibia. Huxley was the first to show that a still wider separation was necessary, the amphibians being more nearly related to the fishes, and the reptiles to the birds; and accordingly he established two great groups of the vertebrate subkingdom: Ichthyopsida for the former, and Sauropsida for the latter classes. Further researches, and especially the numerous discoveries in America of fossil birds and fossil reptiles of an archaic type, have tended to prove that the relationship between reptiles and birds is even closer than Huxley's arrangement would imply, and that the latter may be regarded as nothing more than a peculiarly modified group of reptiles.

Reptiles are cold-blooded, air-breathing vertebrates, with an external epidermic covering of horny or bony plates. The heart consists of two auricles and a ventricle, which latter is rarely completely divided into two chambers; there is only one complete aortic arch. Respiration takes place throughout life by lungs. The alimentary canal and genito-urinary organs open into a common cloaca. The skull articulates with the vertebral column by a single occipital condyle. The lower jaw or mandible consists of several bones, and is attached to the skull by means of the quadrate bone. Both pubes and ischia meet in a ventral symphysis, and the ilia are further prolonged behind the acetabula than in front of it. The ankle-joint of the foot is between the proximal

and distal row of tarsal bones. The metatarsal bones are not ankylosed together, nor with the distal tarsal bones. All reptiles are oviparous or ovoviviparous. The egg is large, and contains much food material, by which the embryo is nourished. The embryo is inclosed in the fetal membranes, the amnion and allantois.

The internal skeleton of reptiles is illustrated in the accompanying Plate of representatives of the four great living orders, Ophidia (serpents), Lacertilia (lizards), Crocodilia (crocodiles), and Chelonina (tortoises and turtles). The broad differences between these orders as regards the skeleton will be seen on reference to fig. 1, Python; fig. 5, Chameleo; fig. 11, Alligator; and fig. 14, Thalassochelys. The backbone or vertebral column is made up of a series of bony vertebrae, very numerous in the serpents, and few in the tortoises. In the crocodiles alone is the distinction of cervical, dorsal, sacral, and caudal vertebrae well marked. The sacrum (absent in the serpents) consists of two or more vertebrae. In the serpents a large number of vertebrae carry movable ribs, which assume the functions of locomotion. In the lizards the vertebrae anterior to the sacral region carry movable ribs, some of which are attached to the sternum, which is a semi-ossified or cartilaginous median plate with a large T-shaped interclavicle or episternum lying on it. In Draco (fig. 10) the more posterior ribs are expanded to support a wing-like membrane by means of which these lizards take flying leaps in the air. The crocodiles have well-developed dorsal ribs articulating with the dorsal vertebrae by two processes, the head (capitulum) and tubercle; from seven to nine of the anterior dorsal ribs are connected by ossified sternal ribs with a well-ossified sternum, provided with an interclavicle. The tortoises agree with the serpents and a few lizards in having no sternum. The vertebrae are few and constant in number, there being eight cervical, twelve dorsal, and two sacral, and a small but varying number of caudal vertebrae. The cervical vertebrae have short transverse processes and possess great mobility. The dorsal vertebrae, together with their expanded ribs, are immovable, and are united together into a carapace, which is covered by large ossified dermal plates. Ventrally the place of the sternum is taken by the plastron, made up of nine similar ossifications of the skin.

The skull differs remarkably in the various orders of reptiles. In the serpents (figs. 1a, 2a, 3) the quadrate bone is movably attached to the skull, and this, together with the movable nature of the squamosal, with which it articulates, and of the palato-maxillary apparatus, cause the mouth to be very dilatable; in addition the rami of the lower jaw are only united at the chin by soft tissue, and are capable of being widely separated. In python (fig. 1a) the maxillae are long and support a number of teeth, and the premaxilla also bears teeth; in the vipers (fig. 2a) the maxillae are short and support a single pair of large perforated poison fangs. Teeth are found usually on the palatine and pterygoid bone, but the premaxilla is without teeth in most serpents. The skull of lizards (fig. 7-9) agrees with that of serpents in having a movable quadrate bone, and in the union of the palatine and pterygoid bones with the maxilla by transverse bones; but the anterior part of the skull is movable on the occipital segment, except in the chameleons (fig. 5); the palate is incompletely ossified. The skull of the crocodiles (figs. 11-13) is solid and well ossified; the quadrate bone is immovable, and there is a very large bony palate, into the composition of which the maxillae, palatines, and pterygoids enter; the teeth are implanted in distinct sockets; the gavials (fig. 12) have the snout elongated. The skull of the tortoises (figs. 14a, 15, 16) agrees with that of the crocodiles in the large solid bones of which it is built up, and in the immovable character of the quad-

rate; the parietals are largely developed, and send down a process to the basi-sphenoid; the dentary bone of the mandible consists of a single bone.

In the development of the limbs there is much variety among reptiles. In the serpents all external traces of limbs has disappeared, and locomotion is performed by the expanded ribs working on the hard scales; in some, however, as the boas (fig. 4), rudiments of a hind limb and its supporting girdle are concealed beneath the skin, but form no connection with the vertebral column. In the lizards both limbs may be well developed, as in the iguanas (fig. 6) and chameleons (fig. 5); or fore limbs only may be present, as in Chirotes, or hind limbs only, as in Pseudopus; in other lizards one or both of the limb girdles may be rudimentary, as in Anguis and Amphisbæna. Except in the apodal forms the pectoral and pelvic girdles are well developed in the lizards; they have clavicles, which are not found in the other groups. In the tortoises both girdles are of a simple character, and the pelvic is not attached to a sternum.

All reptiles breathe throughout life by means of a pair of lungs, one of which, especially in serpents, is much smaller than the other. The jaws are generally armed with conical teeth, but in the tortoises these are replaced by a horny beak; and in some extinct reptiles the front part of the jaws may be ensheathed in horn, while teeth are present in the hinder part. The alimentary canal differs in character in the various orders, but always opens into a cloaca, common to it and the ducts of the urinary and genital organs. A liver with a gall bladder, a pancreas, and spleen are always present. A tongue is usually present. The poison-glands of venomous snakes lie in the head, near the maxillæ, which support the long poison-fangs. The heart commonly consists of three chambers, a right and left auricle, and a ventricle; but the latter is completely divided into two chambers in the crocodiles, less completely in some lizards. There is one complete aortic arch, formed by two great arteries, which arise from the right half of the ventricle, and arching over the one to the right and the other to the left, unite to form the great dorsal aorta. In the crocodiles, although the ventricle is completely divided into a right and left chamber, so that the venous and arterial blood is prevented from mixing in the heart itself, there is an opening between the two great arteries themselves just outside the heart. The right half of the ventricle, or in crocodiles the right chamber, also gives off a pulmonary artery to the lungs. Most of the blood of the hinder part of the body passes through the liver or kidney on its way to the heart. The veins unite into a contractile sinus venosus communicating with the right auricle. The lymphatic system is well developed, and is put into communication with the venous system by a pair of lymphatic hearts. The nervous system, as in all but the very lowest vertebrates, consists of a spinal canal, from which numerous nerves are given off. The anterior portion of the spinal canal constitutes the brain, in which a cerebrum, optic lobes, cerebellum, and medulla oblongata are distinguished. The cerebrum is usually large, but the cerebellum is very small in the lizards. Of special senses, the sense of smell, of taste, and of touch are feeble. The sense of hearing is generally keen, but there is no external ear, except in the crocodiles, where it is rudimentary. The sense of sight is usually very acute, and eyes are always present, though in a very few cases they are very small and concealed beneath the skin. In the serpents there are no apparent eyelids, but the skin over the eye is transparent. In the other reptiles there is often a third eyelid, the nictitating membrane, which can be drawn obliquely over the eye. The urinary organs are distinct from the generative, and consist of kidneys with their ducts; and in the lizards and tortoises a urinary bladder is also present. The sexes are always separated, and the generative organs

open into a common cloaca with the urinary ducts and the alimentary canal.

Living reptiles are divided into four great orders, Ophidia (SERPENTS); Lacertilia (LIZARDS); Crocodilia (CROCODILES); and Chelonia (TORTOISES and TURTLES). A fifth order is constituted by some for a remarkable New Zealand lizard, SPHENODON (or Hatteria).

Reptiles were exceedingly numerous in the Secondary age, and the majority differ so remarkably from existing reptiles that they have to be placed in distinct orders. The order Ichthyopterygia contains the ICITHYOSAURUS and its allies, huge marine reptiles, with the limbs paddle-like and the phalanges numerous. The order Sauropterygia contains the PLESIOSAURUS and its allies, agreeing with the former order in their naked skin and paddle-like limbs, but having generally a small head and a very long neck. The order Pterosauria contains the PTERODACTYLES (flying reptiles), with the outermost digit of the hand enormously elongated to support a flying membrane; the sternum was keeled, as in birds, and most of the bones were pneumatic. The DINOSAURIA (or Ornithoscelida) are of all reptiles, extinct or recent, the nearest allies of birds. The hinder pair of limbs are larger than the fore pair, and were often the sole organs of locomotion; the structure of the pelvis and hind limbs is very bird like; the teeth are lodged in distinct sockets, replaced in some forms by a horny beak in the front part of the jaws. The order Anomodontia contains some forms from the Trias (Dicynodon, Galesaurus), with affinities to the lizards; the maxillæ were sometimes armed with a pair of large ever-growing tusks. Fragmentary remains have also been found in the coal-measures (Eosaurus) and Permian rocks of North America.

REP'TON, a small town of England, in the county of Derby, 5 miles north-east of Burton-on-Trent, and 130 miles from London, being a mile distant from the Willington station on the Midland Railway. It was formerly the seat of the Mercian kings (called Herepandune, Keppandune, Repindun). It contains a large early English church, part of the Black Priory, founded 1172 by Matilda, wife of Earl Randolph, on the site of a nunnery, built before 663, and is noted for its grammar school, founded in 1556, which takes a high place as a public school. The population in 1881 was 2060.

REPUBLIC is derived immediately from the French *république*, and ultimately from the Latin *res publica*. The Latin expression *res publica* corresponds very closely with the English word *commonwealth*, as used in its largest acceptance for a political society. The Latin word *respublica* might be applied to a community under a substantially monarchical government; for instance, it was so applied to Rome under Augustus. The word, however, was more applicable to a society with a popular government than to a society under monarchical rule.

A republic, according to the modern usage of the word, signifies a political community which is not under monarchical government, or, in other words, a political community in which one person does not possess the entire sovereign power. The word *republic* is sometimes understood to be equivalent to *democracy*, and the word *republican* is considered as equivalent to *democrat*; but this restricted sense of the words is inaccurate, for aristocratic or oligarchical communities, such as Sparta, Rome in early times, and Venice, have always been called republics.

REPUBLICS, FRENCH. Of these we count three; the Great Republic, "one and indivisible," of 1792, the Republic of 1848, and the Republic which yet exists to bless France, and under which she has risen to prosperity from the crushing disasters of 1870.

The First Republic (of 1792).—The great outbreak of the 10th of August, 1792, when the Swiss Guards were mas-

sacred, and the mob sacked the Tuileries, resulted in King Louis XVI. and his queen being sent, "for safety's sake," to the Feuillants Convent and afterwards to the Temple prison, and in a provisional suspension of the royal authority, long before little more than nominal. The Legislative Assembly abdicated and called together a new body, a National Convention, which was to decide upon the form of government under which France should in future exist. While the Convention was being elected the prisons of Paris were invaded (on Sunday, 2nd September, 1792) by a mob under the orders of the sanguinary Marat and the Commune (municipality) of Paris; and from that evening onward for a hundred hours, as has been counted, tribunals of two or three persons each, all unknown, sat in the courtyards of the prisons passing swift sentence upon the prisoners brought before them. At the least faltering or suspicion "à la Force" was cried (as if an order of transference to the prison of that name), the outer gate was opened, and the unhappy wretch thrust into a mob of infuriated beasts in human shape, who not only murdered him or her, but insulted the mangled remains with every barbarity. Altogether 1089 prisoners thus perished. The Legislative Assembly (while waiting for the Convention still the supreme body in France) sent deputations daily to try and check this lawlessness, but to no purpose. The slaughter recommenced as soon as the deputations had gone, and continued till it wore itself out. Many members also openly encouraged it; Danton was suspected of being among them, though this has never been proved.

Thus fearfully heralded, the Convention assembled at Paris. Its first act was to declare the abolition of royalty in France and the institution of a republic. The 22nd of September, 1792, was "the first day of Year I. of the Republic, one and indivisible." Roland, excellent administrator and purist itself, was retained as minister of the interior, and the Girondins, representing the bourgeoisie, chiefly scholarly men, and moderate in comparison with Robespierre and the Jacobins, had the majority. The question soon arose what to do with the king. To the horror of all men his death was voted, after a trial, by a small majority (387 against 384), among which his own cousin, the infamous "Égalité" (as the Duke of Orleans had rechristened himself), was to be found. On this news all Europe rose in arms against France.

Among those voting for the king's death were most of the Girondins, who thus showed their inherent weakness by fearing to act upon their real sentiments. The trial lasted from 15th to 17th January, 1793, and the king was sent to the guillotine on 21st January. The Girondins, representing the middle class, anxious to have done with disorder, timid in action and giving way as soon as real disputes arose, were now confronted by Robespierre, Danton, Marat, the Jacobin Club, and the mob. With only a little firmness all the immense good accomplished by the Revolution might have been saved, but of this firmness the Girondins were not possessed. The struggle was not a long one. Roland was dismissed almost at once after the king's death, and on the Girondin General Dumouriez concluding peace with the foe, evacuating Belgium, and marching on France, with the evident object of affecting a counter-revolution, Robespierre and the Jacobins availed themselves of the popular exasperation to propose the creation of the ever-infamous Committee of Public Safety (not one Girondin upon it), whose first act was to send to arrest Dumouriez. He made prisoners of his would-be captors and sent them off over the frontier, continuing his onward course. But his soldiers revolted, rose against him, and he had himself to fly to the Austrian lines with the Orleans princes (one of them, the Duc de Chartres, afterwards to be better known as King Louis-Philippe), and a few soldiers besides. After this, and a royalist rising in La Vendée, the public anger at the supineness of the Girondins made their fall

of easy accomplishment. On the 31st May, 1793, Paris revolted against the Convention, that is, against its Girondin majority; and on the 2nd of June the minority of the Convention arrested twenty-two Girondin deputies. More than half of France rose to defend them, and the royalist *émigrés* began to stream back, thinking their turn now come. But Danton seized the command of affairs. Under his direction the Convention called the army to Paris as far as possible, proclaimed military law in the hostile departments, and in eight days constructed a new constitution, simple and thoroughly democratic. This *Constitution of the Year I.*, as it has come to be called, was sworn to with great rejoicings at the National Feast of the 10th August, 1793. It was never really acted upon; but it freed the hands of the Convention, which had thus fulfilled its duty, and now could fairly regard itself, during the time of disturbance, as the supreme authority in France. The theory was that after the troubles were over the Constitution should come into force. At this moment Marat was assassinated (13th July, 1793). His murder sealed the fate of the imprisoned Girondins, and the REIGN OF TERROR, which is elsewhere fully described, may be said to have commenced from that time. The Girondins were not tried till the 24th October, and their trial lasted six days: they went to the scaffold on the day after their sentence. The queen had perished eight days before them.

Three things of real governmental importance, disconnected altogether with the rivalries of the Terror, which devoured first the Hébertists, then the Dantonists, then the Robespierrists, and lastly, as its own death potion, the remaining Jacobins, ought to be mentioned. (1) The first is the formation of the *Grand Livre*, the registration of the public debt of France, annulling the capital, but promising annual interest or *rente*, which followed upon an excellent report of Cambon, 15th August, 1793. (2) The second is the Revolutionary Calendar, constructed by Romme, aided by Lagrange and Monge, and issued the October, 1793. It began with the proclamation of 6th republic on 22nd September, 1793, which was 1st Vendémiaire, year I. Vendémiaire, Brumaire, Frimaire; Nivose, Pluviose, Ventose; Germinal, Floréal, Prairial; Messidor, Thermidor, Fructidor—these were the names of the months, grouped by Fabre d'Églantine's rhyming, names meaning the months of vintage, fog, and frost; of snow, rain, and wind; of germination, blossoming, and haymaking; of harvest, heat, and fruit. They had thirty days each, divided into three decades, the old institution of Sunday being suppressed and each tenth day being taken as a day of rest instead. This left five days (six in leap year) to be accounted for, therefore a corresponding number of extra days, called "sans-culottides," was added between Fructidor and Vendémiaire—that is, at the close of the revolutionary year. The new calendar was abolished by Napoleon I. in 1806. (3) The third was the adoption of the decimal system of weights and measures, which after a brief temporary trial of the metre and kilogramme was constituted by law 7th October, 1793, though not then carried into operation. This was effected by the later revision of 15th August, 1794, when the franc, metre, are, and gramme were definitely constituted as the legal monetary, linear, superficial, and ponderable units of the country. The foundation of *rente* and of the decimal system are real benefits—which must not, however, be set down to the Jacobins although occurring in their era, because they were the work of men of science, reformers in the true sense of the word, and not active revolutionaries. The Jacobins are, however, entitled to the honour of their acceptance and adoption when they were proposed to them.

The terrible financial troubles that beset this first French Republic have also been referred to in the article REIGN OF TERROR: the means adopted, beyond confiscation of the money of the guillotined, were the issue of *assignats* or

promises to pay, the security for this novel kind of paper money being the "national domains," i.e. confiscated lands. [See the articles *ASSIGNATS* and *MANDATS*.] The extravagance of the government was great, probably during the Reign of Terror something like £12,000,000 a month, as has been calculated; for the number of public functionaries, all of them paid, and the number of those in receipt of public food, had become enormous. Not less than £300,000,000 of assignats were in circulation at the death of Robespierre, as Cambon, the finance minister, officially reported. Yet this enormous sum was so depreciated that General Hoche in La Vendée wrote to the government to send him a horse as he was unable to buy one, and the military requisitions had exhausted those of the countryside; and Pichegru, in command of the army of the Rhine, found his pay melted down in the exchange to £8 a month. With the generals in such destitution the state of the common soldiers may be imagined. Nevertheless the armies made headway even under the Terror, and after its close by the execution of Robespierre (28th July, 1794), with the consequent partial revival of public confidence and closer attention to affairs, things went still better in the wars. Pichegru in the north, Jourdan on the Sambre and Meuse, finished the acquisition of all the course of the Rhine to the sea, and in the winter of 1794-95 Pichegru conquered Holland, his hussars capturing the Dutch fleet by riding across the ice of the Texel. Holland made peace by the surrender of Flanders, Prussia by the cession of the left bank of the Rhine, Spain by the cession of the Pyrenees, and the Italian powers also came to terms. England and Austria alone stood out for war.

On the 1st of April, 1795, and again on the 20th May, the people of Paris, partly pressed by famine, partly desirous of re-establishing Jacobinism, broke into rebellion. These outbursts were followed by some risings of royalists in the south of France, who exacted a most cruel and bloody vengeance for the crimes of the Terror wherever they got the upper hand. Some authorities even give them the palm of savagery! The government, enraged at this beyond measure, having learned that Hoche in La Vendée (where the royalists had for a long time held out) had captured a large number of *émigrés*, sent word that he was to destroy them all. He shot 711. At once Charette, the Vendéan general, shot all his republican prisoners, amounting to 2000.

Finally the *Constitution of the year III.*, the work of the restored wreck of the Girondin or bourgeois party, was brought forward amid universal acclamation to restore peace to distracted France. Its discussion raised a storm. A formidable insurrection of the royalists, aided by all the ruffianism in Paris, on the decree that two-thirds of the Convention should remain to form part of the new assembly, took place on 5th October, 1795. The Convention had alienated those who still remained Jacobins in their heart, the royalists were rising against them; they now turned to the army, and as the army accepted the new constitution, they called the troops to their rescue. Barras was commander, but the real authority was intrusted to a young lieutenant of artillery, who had become known by a brilliant piece of work at Toulon, Napoleon Buonaparte, a Corsican of Italian descent, now by the annexation of Corsica a Frenchman. How he at once quelled the insurrection is elsewhere told [see *NAPOLEON I.*], an astonishing instance of the power of a man of genius in difficult circumstances. But times had now altered: the victory was a victory only, not a vengeance; very few executions followed. The elections were held and the Directory came into being; the Convention, which sat first upon 21st September, 1792, ceased to exist on the 26th October, 1795, so much had been crowded into scarcely more than three years.

The constitution of the Directory was thoroughly republican, but with checks and controls. There were two

councils: the Council of the Ancients, 250 in number, all over forty years of age, with the power of veto; and the Council of 500, all over thirty years of age, who had the initiative in legislation. The executive was intrusted to five directors, served by responsible ministers. To prevent a return to royalism the Convention named as the first directors five regicides, Lareveillière, Rewbell, Letourneur, Barras, and Carnot. The last act of the Convention was to proclaim a general amnesty, in token of which the Place de la Révolution was renamed Place de la Concorde.

The period of the Directory [see also *DIRECTORY*] lasted four years. The Directory attempted to restore public confidence by replacing the dishonoured *assignats* by *mandats* (territorial mandates), which for a time bore a better value. Also by April, 1796, La Vendée was at length thoroughly quitted by Hoche, and a formidable conspiracy under Babeuf having been also quelled, the Directory was fairly floated. The magnificent campaigns of Hoche, Moreau, and above all, of Bonaparte, raised the government to high popularity. Mighty Venice fell, Austria was driven out of Italy, North Italy was made into a republic on the model of France, and Genoa also became the Ligurian Republic; Austria gave up Belgium, moreover, as a condition of peace, (Lisbon, April, 1797). But the evils of paper money, which represented an enormous field for speculators, which cut up property, and kept everything in disorder by their fluctuations, pressed upon the government at home. Men began to show royalist leanings. Even some of the directors were suspected. In this emergency the republican directors appealed for help to Bonaparte, still in Italy; he sent them a plan, and one of his generals, Angereau, to whom Hoche was also added. Bonaparte's advice was followed, and the *coup d'état* of 4th September, 1797, set Barras, Rewbell, and Lareveillière in power, Barthélémy (who had replaced Letourneur) being thrown into prison, and Carnot escaping. Merlin and Neufchâteau replaced them as directors. The majority in the councils was overthrown, fifty-three were sent into exile, and a moderate amount of severity soon quelled the anticipated rising. The general content was dashed by the sudden death of Hoche. The year 1798 saw the downfall of the papal government (February) and of the Swiss Federation (April), and their replacement by republics modelled on the French pattern. The plunder made under the cover of these changes was all sent to Bonaparte, to whom their undertaking was really due, and went to fit out his famous expedition to Egypt, he wishing to gain laurels and strike a blow at England through India (which failed), the directors eager to get the popular hero out of the way at any price. Bonaparte once away, things went wrong. All Europe rose against the Directory, including the five republics it had set up; Spain alone was friendly. The Directory in this strait adopted (28th September, 1798), at General Jourdan's proposal, the fearful burden called the *conscription*, for the manufacture of soldiers, not only never since shaken off from the neck of France itself, but imitated by all countries, one after the other, except enlightened England, which alone remains happily free from that enslaving curse. The men thus gained enabled the Directory during 1798 to advance their whole line, from Brune commanding in Holland to Macdonald (and later on Moreau) at Naples, Masséna being in Switzerland. But this momentary advance ended in a disastrous retreat: Italy had to be evacuated, the Dutch allied fleet deserted, the Irish expedition were taken prisoners on landing, Minorca and the Ionian islands were lost, Bonaparte was beaten on the Nile by Nelson and at Acre by Sir Sydney Smith, and the great Indian ally of France, Tippoo Sahib, lay dead at Seringapatam (May, 1799).

Meanwhile Rewbell had been replaced by Siéyès in the Directory, although the latter was avowedly an opponent

of this method of government, so great was the public dissatisfaction, and Treillard replaced Nœufchâteau. The five directors at this time were therefore Barras, Siéyès, Treillard, Larveillière, and Merlin. The three last were marked out for destruction. Treillard was replaced by Gohier, under pretext of an illegality of election, and the other two were then forced to resign, General Moulins and Roger Ducos taking their places (25th May, 1799). Thus a new revolution had been quietly effected, and the Directory was actually, if not as yet nominally, overturned.

At this moment Bonaparte returned from Egypt, where he had deserted his army, arriving at Paris, 16th October, 1799. At once Siéyès and Ducos offered him the command of affairs, while Barras, Moulins, and Gohier tried to get him away from Paris as commander-in-chief. Napoleon waited his time, and on the 18th Brumaire (that is, the 9th November), 1799, at the head of the army he overthrew the directoral government, Siéyès and Ducos becoming colleagues with him as Provisional Consuls, while Barras succumbed and Gohier and Moulins were arrested. Out of this came the period of the CONULATE, when Bonaparte, as first consul, was in reality possessed of the supreme power. The *Constitution of the year VIII.* was the work of Siéyès, and was published on the 13th December, 1799. It was merely a veiled form of monarchy: the republic may be considered to have ceased; and the history of France becomes from this moment the history of Napoleon. See NAPOLEON I.

The Second Republic (of 1818).—The downfall of the Empire of Napoleon I. was followed by the restoration of the Bourbon Louis XVIII., brother of the beheaded King Louis XVI., and he was succeeded by a third brother, Charles X., in 1821. In 1830 a well-merited revolution drove out the Bourbons and placed their relative, Louis Philippe, Duc d'Orléans on the throne; but though popular at first, his bourgeois temper, his mediocre abilities, his selfish family policy, and a run of commercial and agricultural distress, even amounting to want, made him at last so unpopular that in 1848 he might rather be said to have run away from a contemptuous people (taking flight characteristically in a hackney cab) than to be driven out of France as a deposed monarch. In the Chamber of Deputies the republican party at once sprang to the front, proclaimed the re-establishment of the republic, organized a provisional government, accepted the old republican tricolour, adding a red rosette only, and promised work to all (February, 1848). In April the new Constituent Assembly met, and named an executive of five members, Lamartine, Arago, Garnier-Pagès, Marie, and Ledru-Rollin. Louis Blanc it was who made the fatal proposition of work for all, that is, practical socialism. Of course it broke down speedily on the question of finance, and by June the country distinctly made it understood that they would no longer support the artisan class (which is the actual outcome of all such measures); the latter, however, would not relinquish its new privileges peacefully, and a short civil war had to be waged for a few days in the Faubourg St. Antoine. The national workshops were actually closed on the 3rd of July. General Cavaignac had been named dictator in the crisis, but honourably laid down his command at its close. He was then named provisional president of the council, with the right to nominate ministers. Thiers and Changarnier (Orléanists) headed one party in the assembly, Louis Napoleon Bonaparte (son of Queen Hortense and nephew of Napoleon I.) headed another. The constitution had been thus settled: a president, elected every four years as in America, but not re-eligible for a second term immediately succeeding the first; a council of state chosen by the assembly, and renewed every six years; and a legislative assembly of 750 members. The election for the presidency took place 10th December, 1848. Prince Louis Napoleon stood for the office in opposition to the genuine republican

Cavaignac, and was elected by nearly five and a half millions of votes against Cavaignac's less than a million and a half. The prince-president took office 20th December, 1848.

A reference to the article NAPOLEON III. will show the shameful way in which this arch-schemer abused his trust, never resting until, on 2nd December, 1851, he covered his name with everlasting infamy by the bloodshed of the *coup d'état*, shooting down women and babes in the streets with the mere object of exciting terror, while the best blood of France was being exiled from her shores. The new constitution of 1852 named Napoleon president for ten years, and followed the consulate in other features; brutal severity repressed every outbreak, lavish generosity rewarded every act of sycophancy. Finally, on 4th November, 1852, France had the madness to put herself under the heels of a gang of adventurers, by a vote of 7,824,129 against 253,149, which proclaimed Napoleon III. emperor of the French.

The Third Republic (of 1870).—The rule of Napoleon III. as emperor was a disastrous time for France. Although a pinchbeck splendour was kept up the country was honeycombed by corruption of all kinds, ending in the overwhelming disaster at Sedan, 1st September, 1870, when Napoleon himself fell into the hands of his foes with his whole army of over 80,000 men. The news reached Paris in spite of infinite precautions, and at once (4th September, 1870), the third republic was proclaimed, the temporary government being composed of M. Thiers, Jules Favre, Jules Simon, and Gambetta; half the soldiers of France being in German prisons, and the other half locked up in Metz. The struggles of these brave Frenchmen, their nobility under defeat, their courage to rise again from their desolation to their present position as once more a leading power of Europe, are amply shown in the article FRANCE.

Briefly we may say that a reaction from the evils of mob-law overthrew the first French republic, and a reaction from the evils of socialism the second; and that a truly democratic spirit, based on the knowledge of the crimes of absolute government, and of the absurdities of the hereditary principle, has founded the third upon foundations so broad and so stable that it bids fair to endure, even as the republic of America has already endured, and like that to become more secure with advancing age.

REPULSION is that force with which bodies, or the particles of bodies, tend to recede from one another. The phenomena of light, heat, and elasticity make it probable that at very small distances both attractions and repulsions take place. The only repulsive forces exerted at visible distances are those which take place between the similar poles of magnets, between bodies similarly electrified, and between electric conductors conveying currents in opposite directions; and those forces are always accompanied by attractions between opposite poles of magnets, between bodies oppositely electrified, and between conductors conveying electric currents in the same direction.

REQUIEM (Lat. *requiem*, rest), the name of a Mass sung in the Roman Catholic Church for the repose of the dead, beginning *Requiem æternam, dona eis, Domine* ("Eternal rest, grant thou them, O Lord," &c.), and in its liturgy called *Missa pro defunctis*. The most celebrated requiem music is that which was composed in his dying hours by Mozart, and after that the famous requiem of Cherubini.

REREDOS, the wall or screen at the back of an altar, usually richly panelled and ornamented with niches, pinnacles, statues, &c., frequently painted also with brilliant colours. Reredoses are of all sizes, from a simple altar back to an elaborate structure extending from wall to wall, and almost up to the ceiling. See the magnificent specimens at Durham and Gloucester cathedrals. The name was formerly (but is not now) applied also to the

wood-screen separating nave and choir; and in domestic architecture to the open fire-place found in old-fashioned halls.

RESCUE, in law (*rescous*, from the old French word *rescousser*, to recover), is the unlawful and forcible setting at liberty a person or goods then in lawful custody. A rescue may be either a criminal offence or a civil injury, according to the circumstances under which it is effected. The character of the criminal offence is determined by the character of the offence committed by the person rescued. If, for instance, a party has rescued a traitor or a felon, he has committed the offence of treason or felony. A rescue committed under other circumstances is a misdemeanour. An indictment for a rescue must set out the circumstances under which the person, &c., was arrested and the rescue effected, so as to show that all things existed necessary both in fact and intention to create the offence of rescue, and to enable the offender to disprove them.

RESEDA/CEÆ, an order of plants belonging to the **POLYTRICHALES**. The species of this order are soft herbaceous plants, or in a few instances small shrubs with alternate entire or pinnately divided leaves and minute gland-like stipules. The flowers are in racemes or spikes. They are natives of Europe, the adjoining parts of Asia, the basin of the Mediterranean, and the adjacent islands. A few species occur in the north of India and the Cape of Good Hope. There are four to seven divisions in the calyx and corolla. The stamens are generally numerous, and are not covered in the bud by the petals, which are small and often irregular. In the pistil there are from two to six parts; there are numerous ovules. The seeds have a curved embryo without albumen.

None of the species possess very active properties. *Reseda luteola* is the woad or weld that is used in dyeing. *Reseda odorata* is the common mignonette. It is a native of the north of Africa and Egypt, but its delicious fragrance has caused it to be cultivated all over the world. It is naturally an herb, but when trained in the greenhouse it becomes shrubby. This plant is in great demand in the London markets, and is very extensively cultivated. The seeds should be sown or transplanted into pots, four or six plants, to a pot 4 inches in diameter. The arborescent plant called tree-mignonette may be propagated by seeds or by cuttings, which readily strike root.

RESERVE FORCES. See **ARMY** and **NAVY**.

RESHT or **RASHT**, a town of Persia, in the south-west angle of the Caspian Sea, 16 miles from its port of Enzeli, is the capital of the province of Gililan. It lies in an unhealthy site, but is one of the most prosperous places in Persia, with good houses and paved streets. Silk was formerly its chief article of trade, but owing to disease among the silkworms rice is now the chief export. The town occupies an important position on the commercial highway by the Caspian to Persia.

RESIDUAL AIR is the air still left in the lungs even after a very deep forced expiration. This amounts on the average to nearly 2000 cubic centimetres; that is, about 125 cubic inches. As a rule there is much more air than this (nearly double) left undisturbed in the lungs by ordinary breathing.

RESIDUAL MAGNETISM. When a bar of soft iron is converted by an electric current into a magnet, it does not become instantly magnetic; and conversely when the current is withdrawn it does not instantly cease to be a magnet. The small magnetization remaining after the cessation of the current is called residual magnetism. It is of some inconvenience in telegraph workings, &c.; therefore perfectly annealed iron of certain qualities which has very little residual magnetism is held in great estimation for such purposes.

RESINS are vegetable substances exuding or obtained from many plants. These substances melt at a gentle

heat, and are usually soluble in alcohol, but insoluble in water. Most of the exuding resins are produced by the oxidation of a volatile oil contained in the plant. Some are fossil resins, as amber and asphalt. Many resins contain benzoic or cinnamic acids, as benzoin, Peru and Tolu balsams, dragon's blood, and storax. These resins are used in medicine, as also many others which do not contain these acids, as scammony, jalap, gamboge, galbanum, ammoniacum, asafoetida, guaicum, sagapenum, and myrrh. Others are used for the odour in burning incense, as olibanum. Some are largely used in making soap, as colophony or common resin. The principal consumption of resins is in making varnish and French polish; lac, mastic, copal, dammar, sandarac, and others are employed in solution in spirits of wine, wood naphtha, and turpentine for these purposes. The resins will be found noticed under their respective names.

RESISTANCE is a force by which motion, or tendency to motion, in any body is impeded or prevented. When a load exerts a straining action upon a solid body, the force with which the particles of that body oppose that action constitutes a resistance of one kind. [See **MATERIALS**, **STRENGTH OF**.] Again, when a body is made to slide on another, the inequalities of the surface of both create a resistance of a different kind. [See **FRICTION**.] When a body moves in a fluid, the inertia of the fluid particles displaced by it produces a third kind of resistance; for instance, the resistance against a cannon ball moving in air.

In investigating the resistance of fluids against bodies moving in them, it is supposed that the particles on being struck are repelled perpendicularly to the front of the moving body; but, in fact, the particles of the fluid are in part repelled from the front in oblique directions, and, on account of the compressed state of the surrounding fluid, these particles not being able immediately to escape laterally, there is produced in front more or less accumulation, and consequently an increase of resistance. The gliding of the fluid over the sides of the moving body creates also a resistance from friction; and when the velocity is very great, the fluid not falling towards the hinder part of the body so fast as the latter moves, the pressure there which would serve to counterbalance the pressure in front is in part or wholly removed. On these accounts it is that military projectiles are subject to such vast retarding forces. It is computed that a 21-pounder ball meets with a resistance equal to 800 lbs. when its velocity is equal to 2000 feet per second. Like effects take place in the movement of boats or ships; when the velocity is great the water accumulates in front, and flowing off from thence obliquely, it carries away some from the sides, and, causing the surface of that which is near the stern to be rather lower than the general level, it there produces a diminution of pressure, while there is an excess of pressure in front through the accumulation.

From the experiments of Telford, the following values of the resistance experienced by loaded carriages on level roads were determined. On a good pavement the resistance is one-seventieth of the weight of the carriage and load; on a broken surface of old flint, one thirty-fifth; on gravel, one-fifteenth; and on a well-constructed railway, from one three-hundredth to one two-hundred-and-fiftieth.

RESOLUTION OF DISCORDS. See **DISCORDS**.
RESOLUTION OF FORCES. See **COMPOSITION OF FORCES**.

RESONANCE. Resonance consists essentially of sympathetic vibration; and any body which is easily set into vibration, and which continues to vibrate for a long time before coming to rest, is suitable to exhibit its phenomena. Such a body will respond to feeble impulses if they are continuous and precisely periodic, and of course with a

periodicity exactly akin to their own. Thus if a string of one violin be sounded near another violin with a string precisely in tune with the first, this will be set into vibration; or if a vocalist sings a steady note into a pianoforte (with the dampers raised) the corresponding strings of the instrument will vibrate. If the pitch be exact in each case the resonating body will often, indeed, sound louder than the body originating the sound; such is the power of periodic impulse. The action of swinging may serve for a rough illustration of this power, where slight impulses at the right point produce effects out of all proportion to their own power. The soundboard of the pianoforte struck by such gentle force as that of the waves of air set in motion by the voice (in the experiment mentioned above), and communicating its own sympathetic vibration to the string stretched above it, only by the points where the string is fastened, can act with but infinitely small power; and yet the accumulated force due to the exact periodicity of impulse rapidly becomes such as to set the whole string in vibration of perhaps considerable intensity.

Stretched membranes will respond readily by vibrating to sounds in accordance with their own proper tones, though they do not give out answering sounds. If they are strewn with light sand they will cast it into various lines and figures, which vary in a regular manner according to which tone of the membrane is being excited at the moment. Every inclosed mass of air has certain proper musical tones which may be evoked by blowing across the orifice, or by sounding a tuning-fork, or otherwise producing sound of the required pitch in front of the orifice, or by communicating vibrations by actual contact with the walls of the inclosure. The tones thus evoked reinforce the original sound, and produce the phenomena called *resonance*.

The finest example of a resonance-box is the violin (with the viola and violoncello, &c.); and by blowing across the sound-holes the lowest and most powerful proper tone of good violins is found to be a rather sharp *c'* (middle *c'*), with from 260 to 270 vibrations. The viola gives a similar (lowest) proper tone of *bb*, two semitones below that of the violin. The violoncello gives *F* to *F#* as its lowest or chief proper tone. With the violoncello and violin, therefore, the greatest resonance is a rather sharp Fourth to the lowest string, but with the viola it is a Seventh—and this is held to account probably for the peculiarly altered tone of the viola, which is quite distinct from that of either of its great companions. The consequence of this peculiar relation of resonance is that those tones of the strings which lie near to the proper tones of the inclosed body of air will be proportionably more reinforced. This is clearly perceived in the violin and violoncello, especially for the lowest proper tone, when the corresponding notes are produced on the strings. They sound particularly full, and their primes are most remarkably reinforced. As a net result the upper partials of the lower notes are favoured by resonance, and the primes of the upper notes; and this is evidently one cause of the exquisite smoothness and equality of tone pervading the enormous register of a good violin. It has not been thought necessary to deal in detail with the proper tones of violins other than the chief or lowest tone.

Another large and important class of resonance-chambers is the pipes of organs and of wind instruments in general, all of which act by reinforcing those tones in the rapid irregular vibratory flutter of the lips or the reed which are in harmony with their own proper tones, and by thus controlling the vibration into regular sonorous waves, so that it may produce a steady musical tone.

But at once the most interesting and the highest in character of all musical instruments is the human voice; and this consists in essence of a vibrating double reed of a special kind (the vocal chords) attached to a resonance-

chamber of peculiar and varying shape. Each vowel has its distinct shape of mouth, and owes its sound, in fact, to this shape; and as the shape of the mouth-chamber varies so do the proper tones of that chamber. Hence arises a curious branch of acoustics, the investigation of Vowel Qualities of Tone, which will be better treated under that heading.

The properties of resonant-chambers are largely made use of in the study of sound. Thus a tuning-fork, whose vibration rapidly ceases, and is at the best not strong, is made comparatively lasting and strong by being mounted on a resonance box tuned to its tone. It becomes so sensitive that if another fork of exactly the same pitch be sounded near it, it will begin to sound vigorously of itself, and will continue sounding after the first is checked. It is almost impossible to set an unmounted fork into vibration by sympathy. The use of resonant chambers to analyse musical sound is dealt with under *RESONATOR*.

RESONATOR is the name given to a most valuable philosophical instrument for the analysis of sound, invented by the famous Helmholtz, to whom the present entire reconstruction of acoustics is due. In fact many of Helmholtz's greatest discoveries are due largely to the powers of this remarkable instrument.

In the article *RESONANCE*, the vibratory powers of elastic plates (as soundboards), of stretched membranes, and of inclosed masses of air, are spoken of: all of these having the property of sympathetically resonating to a sound which is in exact correspondence with one of their own proper tones. If a bottle-shaped cylinder, open at both ends, be taken, and a membrane (say a piece of wet bladder) stretched tightly across the end answering to the bottom of the bottle, then this membrane will be made extremely sensitive to tone because of the additional resonating power of the inclosed mass of air. If a tiny pendulum (one made, say, of a drop of sealing-wax suspended by a thread of unspun silk) be suspended across the membrane thus fixed, it will be thrown into violent vibration whenever the prime tone of the membrane is sounded in its neighbourhood. There is, of course, also a possibility of vibration in sympathy with other tones than the prime tone occurring, but the resonance of the prime tone is so much more forcible than that of the others that mistakes are not likely to occur on this score. It is manifest, then, that any compound tone—and almost every musical tone is compound [see *ACOUSTICS*!—on being sounded near such an instrument, will be analysed by it, and if among its various partials one is in accord with the prime tone of the membrane it will set it in vibration. If none of its partials is of the pitch of the prime tone of the membrane the latter will remain still. By having a number of such instruments a number of tones may be detected, and their presence proved to a class of students; but as they are only faintly sensitive to feeble tones, they are not nearly so valuable for purposes of investigation as the resonators proper.

Helmholtz's Resonators.—These are hollow spheres of glass or metal, or tubes, with two openings. The smaller funnel-shaped opening is for insertion into the ear, and is coated with melted sealing-wax moulded to the exact shape of the tube of the ear while still soft, so that the resonator fits easily and is air-tight. (The other ear should be plugged during the experiments.) The resonator thus prepared reinforces its own prime tone in a most remarkable manner and is extremely sensitive. It is evident that it is of use only for resonating one particular tone, and only to the person experimenting. It is in essence, however, an adaptation of the resonating membrane already described, the membrane of the ear replacing the artificial membrane which closes the bottle. It is curious to use a resonator amidst ordinary noises, the whistling of the wind, the splashing of water, the rattling of wheels, &c. It selects the momentary occurrences of its own note, and brings it

into the ear with great noise, when of course the unassisted ear is entirely unable to detect the existence of any musical tone whatever. A properly tuned series of such resonators will enable an investigator to detect with absolute accuracy all the partial tones of various pitch included in any compound tone (*i.e.* ordinary musical sound), just as a prism sorts out the coloured rays whose union makes up white light.

It is, of course, not necessary to give many measurements of resonators here, but a few may be of service in making the description more precise. The resonator for *g* (the *g* below middle *c'*) is a glass sphere 15.1 millimetres in diameter, say 6.06 inches; that for *g'*, the octave above, has a diameter of 7.9 millimetres, say 3.11 inches; and they even go down to as small as 1.3 millimetres diameter, a trifle over $\frac{1}{4}$ inches (1.63), which resonates *d''*; beyond this they are not very effective.

Spherical resonators are the best, because their lowest proper tone or prime tone is such a long way beneath their next proper tone above, and confusion is thus avoided. Those with a narrow opening are the most powerful, but need a very much closer agreement in pitch with the tone examined than the resonators with a wider opening require. It is as with microscopes, the greater the power the smaller and dimmer is the field of view.

The action of resonators may be made visible to a class by an ingenious application of Herr Koenig's. Taking a spherical resonator with two equal openings, he closes one with a thin india-rubber membrane. This latter forms the roof of a tiny box, into which a small stream of gas is delivered, while a fine-pointed burner on the opposite edge of the box allows the gas to be lit. When the prime tone of the resonator is sounded the air in the resonator is set into violent vibration as usual, and consequently the india-rubber membrane also; thereby a periodic flutter is imparted to the gas, and the flame leaps up and down, or oscillates, in a rapid and regular way. Frequently the oscillations are too rapid to be seen, but the flame may be observed to alter its form and colour. To examine the oscillations they must be viewed in a rotating mirror, when they appear drawn out into a long toothed ribbon of flames. When the resonator is at rest the ribbon of flame shown in the rotating mirror has smooth edges. A number of students can therefore see at once whether the resonator is acting or not.

RESORCIN is a derivative of benzol or phenol; the formula is $C_6H_6O_2$, and it is homologous with orcin ($C_8H_8O_2$). It may be obtained by the action of fused potash on gualbanum and some other gum resins, or by the dry distillation of extract of Brazil wood. It crystallizes in large white plates; it melts at 44°C . (110°Fahr.) and volatilizes unchanged. It is very soluble in water, and also in alcohol, ether, and oils. It possesses powerful antiseptic properties and coagulates albumen. It is employed in medicine in doses of 5 to 30 grains, its internal action resembling quinine. It is also used externally in diphtheria and other diseases, and in the manufacture of some of the coal-tar colours. The aqueous solution forms a violet colour with ferric chloride.

RESPIRATION (Lat. *re* and *spiro*, I breathe again) is the act of continued breathing. Its object is to introduce a fresh supply of oxygen into the system, that the products resulting from the breaking up of the various tissues of the body may be removed by the agency of the excreting organs—the skin, lungs, kidneys, and the like—and to eliminate the most noxious of these products, carbonic acid. This is effected through the lungs in air-breathing animals, and through the branchiae or gills in water-breathing animals. In other words, respiration is the arterIALIZATION and purification of the blood by exposing it to constant supplies of fresh air. All animals must breathe air. Water contains a considerable quantity of air, which can

be expelled by boiling. A fish placed in water which has been boiled and then cooled will die, just as a man would, in similar circumstances, from want of air or suffocation. Even water-breathing animals, therefore, must also *inspiro* and *respire* air.

Corals, Hydrozoa, &c., it is true, have no special respiratory organs, but then the air is admitted freely to all parts of the body. The same is the case with insects, and they possess, in addition, an express provision for introducing the air into the system. In their cavities, or stigmata, are found which communicate freely with the atmosphere. These stigmata open into canals which lead into the two tracheae (or windpipes) that traverse the sides of the body, and which are connected with each other by several tubes running across the body. From these tracheae branch off others, which, with their subdivisions, reach all parts of the system. In the more perfect ones, the tracheae are expanded at intervals into air sacs, which are found on the largest scale in those insects intended to sustain long flights, as for instance, in the common bee. They appear to serve a double purpose; the motion during flight partially closes the stigmata, and hence the air-sacs serve as reservoirs of air; they also increase the buoyancy of the body. Other members of the Arthropoda are furnished with a somewhat similar mechanism for the arterIALIZATION of the blood.

In other divisions of animal life we find a special respiratory apparatus provided, and constructed with marvellous ingenuity, so as to present the greatest number of surfaces to the action of the air. As already hinted, this apparatus is either a lung or a gill. When placed within the body it is called the former; when situated externally, the latter.

The simplest form of *gill* may be seen in the Mytilus larva or caterpillar. Here, in little tufts at the side and at the tail, are placed the gills, in which the air acts upon the nutrient fluid of this little creature. Compare this modest contrivance with the apparatus of that curious amphibian, the *Proteus anguinus*, which presents the simplest form of *lungs*. A pair of elastic membranous bags are placed close beneath the vertebral column, communicating with the atmosphere by a trachea, which opens through the larynx into the throat. These bags are lined by a thin, moist, delicate membrane, called the mucous membrane, imbedded in a vascular network, which carries all the blood in the animal's body to the heart. The partition between this network and the interior of the lungs is so thin that, after having dissolved the oxygen of the air it allows it to pass freely into the flowing blood; while, on the other hand, it conveys carbonic acid in a reverse direction from the blood into the air.

The most perfect example of gills is to be found in fishes. They are situated, as everybody knows, in rows at each side of the throat, with two sets of apertures, the one opening upon the outside and the other communicating with the throat. A continual stream of water passes through them. The blood is conveyed to these organs from the heart. The act of respiration can only take place when the gills are moist; and if a fish is taken out of water they clog and become dry, and the fish perishes of suffocation. But keep the gills moist and it will continue to breathe, though kept out of its native element. There are some species of fish, as well as molluscs, which pass a portion of their brief careers in the air, and these are accordingly provided with a most ingenious piece of mechanism. A number of cavities is made by the arrangement of the bones at the back of the mouth, and these serve as reservoirs of water, which maintain a constant moisture of the gills during their residence in the atmosphere. Most of the fishes thus supplied are natives of tropical climates, where, in the hot season, the shallow lakes frequently dry up. One very singular specimen is the *Anabas*, a fish not unlike the perch, and provided, like

it, with spines. It can live for a time out of the water, and by means of its spines actually climbs bushes in search of its prey, a species of land crab commonly found in such situations.

Reptiles are furnished with lungs that communicate with the month. They do not inhale the air like animals, but swallow it. As they have but a one sided heart only part of the blood which circulates through the body becomes arterialized; hence their cold blood and the imperfect development of their general vitality.

Owing to their great occasion for muscular energy birds possess a more active respiration than the Mammalia. The trachea or windpipe divides into two bronchi, which, subdividing, form very minute air capillaries, as in man. [See LUNGS.] But in birds the air, which enters by the trachea, not only passes into the lungs, but by means of the bronchial tubes passes into air-cells disposed over various parts of the body, which communicate with the interior of the bones, diminish the specific gravity of the body, and serve as reservoirs for air.

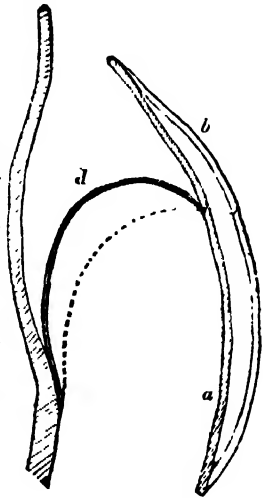
In man and all the other Mammalia, the lungs are contained, along with the heart and the great vessels arising from it, in a closed cavity called the thorax, bounded above and at the sides by the ribs and their muscles and attachments, as will be found elsewhere fully described. See LUNGS.

Such being the organs, we have now to examine the processes of respiration. The first step is a sensation of a stifling character in the chest, due to the circulation of the venous blood in the lungs, which always impels us to the act of inspiration. This again is succeeded by the act of expiration, which usually requires no muscular effort; it is the natural effect of the elasticity produced by the resistance of the chest and lungs to the distension during inspiration. But when the sensation produced by the presence of venous blood in the lungs has been more than usually intense, the ribs and diaphragm are brought back to their position with force and rapidity, and the thorax contracted into less than its ordinary limits.

The mechanism of the inflation and (partial) exhaustion of the lungs is as follows:—Over each side of the chest spreads a great muscle, which may be likened to a hand with outstretched fingers laid on the chest, the fingers pointing downward and forward—only, instead of five fingers, it has nine indigitations. Each of these indigitations is attached to one of the nine upper ribs, and the back part of the muscle is fixed to the posterior edge of the shoulder-blade. From the direction in which the ribs are curved, first outward, then downward and forward, any force acting on them from above and behind pulls them upward and outward, and so increases the capacity of the chest. The muscle which has just been spoken of does so constantly; but there are others which do so only occasionally, such as those which run from the chest to the bone of the arm. An asthmatic person may be seen, when the fit is on him, holding by the arms of his chair, to make them fixed points for these muscles to act from upon the chest; and he holds up his head to make those muscles of the neck co-operate in inspiration which are attached to the collar-bone and to the upper rib.

But the principal muscle of inspiration is one which separates the cavities of the chest and the abdomen—the diaphragm. It forms an arched floor to the chest, having its edges attached to the ribs and to the breast-bone at the sides and in front, and to the spine behind. It is represented in the accompanying figure by the arched line *d*, as in a state of rest. When it contracts it necessarily tends to become straighter, like the dotted line—it therefore increases the capacity of the chest; the lower parts of the lungs descend with it, while the upper parts rise with the ribs and breast-bone *b*, and thus the chest is enlarged both upward, and outward, and downward at once. As the dia-

phragm descends it pushes the contents of the belly before it, so that, at the moment when the breath is drawn in the belly becomes more prominent. At this time the abdominal muscles *a*, closing the belly in front and at the sides, are relaxed. When the diaphragm and elevators of the ribs cease to act the chest falls, the abdominal muscles press the bowels, &c., up against the hollow of the diaphragm and push it into the chest; the capacity of the chest is thus lessened in every direction, and the air which had been drawn in is again blown out or expired. Ordinary observation shows at once that men breathe more with the diaphragm (*i.e.* by movements affecting the abdomen), and women more with the ribs (*i.e.* by movements affecting the chest).



Action of Respiration.

There can be no doubt that the respiratory movements, though partly under the influence of the will, are essentially "automatic" or self impelled in their nature. Their chief centres, says Dr. Carpenter, consist of two ganglia, corresponding to the origin of the pneumogastric nerves. These are the principal excitator nerves conveying the stimulus on which these movements are dependent; whilst from the adjacent parts of the medulla oblongata and spinalis proceed the chief motor nerves by which they are carried out. So that the whole of the encephalon (brain) may be removed from above, and the spinal cord up to the origin of the phrenic nerve, from below, without any suspension taking place of the most important respiratory movements.

That they are usually independent of the will may be inferred from their systematic occurrence during sleep, in apoplexy, and cases of absolute paralysis. That the will can to some extent control them is evident from the fact that we may suspend them for a minute or more, if we have previously furnished the lungs with a supply of fresh air.

The movements of inspiration and expiration occur, on the average and in a healthy state, about once for every four pulsations of the heart, and therefore about sixteen or twenty times in a minute. The act of inspiration occupies longer than that of expiration, being in the ratio of twelve to ten in adult males, and fourteen to ten in females, children, and the aged. At different periods of life the respiratory movements occupy a longer or shorter time. Thus—

The respirations at birth average	44	in 1 minute.
"	at 5 years of age	26 "
"	from 15 to 20	20 "
"	from 20 to 25	18 7/8 "
"	from 25 to 30	16 "
"	from 30 to 50	14 7/8 "

But disease affects the respiration. In inflammation of the lungs the respiratory movements occur in the ratio of one to every three, or even two, pulsations of the heart. In hysteria they will mount up to seventy, eighty, and ninety per minute. On the other hand, in typhoid and low fevers, and under the influence of narcotics, the ratio of respirations to pulsations will sink to as low as 1:7.

When the air has passed through the bronchi, and is permeating the small capillary vessels, the physician, if he applies his ear or stethoscope to his patient's chest, dis-

tinguishes a gentle murmuring sound. This is termed the *respiratory murmur*. Now if any part of the lungs should, by disease, become impervious to air, this sound will be materially modified, or will become inaudible, and it is thus that the physician, by the act of auscultation, is enabled to detect many maladies of the respiratory organs.

The average quantity of air which the lungs take in at each inspiration is easily discerned by means of the *spirometer* invented by Dr. Edward Smith. As the result of many experiments Dr. Smith places it at 33·6 cubic inches, when a person is at rest; 52 inches if he walks at the rate of 1 mile per hour; 60 inches if he walks 2 miles; 75 if he walks three; and 91 cubic inches if he walks 4 miles per hour. We have thus between 30 and 40 cubic inches for the average quantity of air exchanged at each respiration.

The total amount of air which passes through the lungs in twenty-four hours will, of course, be regulated by the number and extent of the respiratory movements. Dr. Smith gives the average quantity during the night at 400 inches per minute, which in six hours would amount to 144,000 cubic inches; during the day, at 502 cubic inches per minute, which in eighteen hours would amount to 542,160 cubic inches. Total for the twenty-four hours, 686,160 cubic inches. But this enormous sum is greatly increased by active exertion; and in the case of a labouring man the total amount respired will not be less than 1,560,000 cubic inches.

We shall now allude to the nature of the change which the air undergoes in the lungs. In the first place its oxygen disappears. The proportion of nitrogen is generally the same as in unrespired air, and is sometimes greater, sometimes less. Hence it is inferred that there prevails, to a certain degree, both a constant absorption and exhalation of this element. The quantity of carbonic acid averages about 4·35 per cent., and in twenty-four hours an adult man, in a state of rest, exhales an amount of carbonic acid equal to 7·144 ounces of carbon; if a hard-working artisan, 11·7 ounces. It is greater in robust than in slender men; in males than in females (except during the pregnancy of the latter); in youth than in old age; after than before muscular exertion; in a waking state than in sleep; and after than before food. It is increased by external cold, and diminished by heat, and varies according to the temperature and moisture of the air, the nature and quantity of the diet, and various other causes.

The amount of watery vapour exhaled from the lungs in twenty-four hours ranges between 7 and 12 ounces. It is not pure water, but contains in solution a decomposed albuminous substance and a considerable quantity of carbonic acid.

It has been justly observed that a constant supply of fresh air is an absolute necessity of our nature. If we are deprived of it we die at once; if the air is vitiated we suffer languor, which very often results in disease. For the air which, as we have shown, is introduced into the lungs by so ingenious a system, passes into our blood, and becomes a portion of ourselves. The heart beats about seventy-two times in one minute. Each pulsation sends to the lungs 2 ounces of blood. Thus, 146 ounces, about an imperial gallon, are despatched to the lungs for the purpose of arterialization or purification every minute. In one hour there are sent 450 pints; in twenty-four hours nearly 11,000 pints. The blood performs a complete circuit in our system in 110 seconds, and no less than 640 circuits in twenty-four hours. In every eight minutes of time there are three complete circulations of the blood. The object of this beautiful arrangement is to effect its complete ventilation. The remembrance of these facts should induce us to guard ourselves against exposure to vitiated air, while they clearly explain the cause of the languid, enfeebled, and unhealthy look common to the dwellers in

the alleys and lanes of smoky cities, compared with the robust, fresh, and vigorous appearance of the hardy mountaineer. Pure air is even more needful than good food. And society can have few greater benefactors than the sanitary reformers, who endeavour, by the introduction of improved systems of drainage, the restriction of the number of tenants allowed to live in one house or room, the opening up of narrow alleys, and other wise provisions, to supply the artisan or mechanic with fresh and wholesome air. Every one who increases the health increases the wealth of his country, and promotes the happiness of his countrymen.

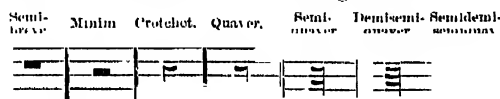
RESPIRATOR (or breath-warmer), an instrument for giving warmth to the air drawn into the lungs in breathing, and thereby enabling invalids to whom cold air is injurious to enjoy the benefits of exercise in the open air without injury or inconvenience.

The apparatus usually consists of from eight to twelve frames of sheet-silver or other metal, about $3\frac{1}{2}$ inches long, $1\frac{1}{2}$ inch wide, and $\frac{3}{16}$ part of an inch thick; the metal of which is pierced away by machinery so as to leave merely a narrow frame containing six vertical bars of $\frac{1}{16}$, and five horizontal bars of $\frac{1}{16}$ of an inch wide. On both sides of each of these frames a layer of wires $1\frac{1}{2}$ inch long and $\frac{1}{16}$ of an inch thick is soldered, care being taken to connect each wire, not only with the top and bottom bars of the frame, but also with each of the five horizontal bars. The wires are laid about $\frac{1}{16}$ part of an inch apart, and are so numerous that a large respirator of high power contains 2000 feet of wire, divided into about 12,000 pieces, and soldered to the frames at more than 80,000 distinct points. The frames or lattices of wire-work are fixed parallel to each other, and kept a short distance apart by small studs of a substance which is a slow conductor of heat, so that the inner layer is always kept as nearly as possible at the temperature of the air expelled from the lungs, and each successive layer diminishes in warmth, till the outer one is nearly as cold as the external air. The curious and philosophical application of a non-conducting medium between the metallic screens is essential to the perfect action of the instrument, as without it the heat would be equally diffused, and no part of the metal-work could retain more than half the temperature of the breath. By this arrangement the air inhaled, finding each layer of wire warmer than the preceding, is gradually raised, in respirators of the highest power, to the greatest attainable temperature. These instruments are more especially useful in diseases of the lungs.

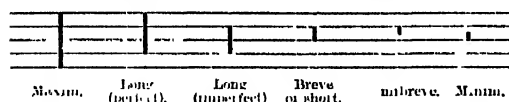
Stenhouse's Respirator, for use in an atmosphere charged with deleterious gases or vapours, is a small box which fits over the mouth and nose. The front of the box consists of wire gauze, and the box itself is filled with highly porous charcoal, preferably that made from the shell of the cocoa-nut. As the air passes through the charcoal on its way to the mouth and nose, all the deleterious gases are removed, in consequence of the great absorptive power of the charcoal. For use in rooms full of smoke, as in burning buildings, or in dusty atmospheres, Professor Tyndall recommends a respirator packed with cotton-wool. The wool completely filters the air from all the solid particles which are suspended in it, and to which its irritative effects are due. This respirator has been used with considerable success.

RESPONSORIUM, the name of the species of antiphon sung after each of the nine lessons at matins in the office of the Roman Catholic Church, and also in similar positions in other offices. There is consequently a large number of *responsoria*, and a considerable mass of music for them in Roman Catholic Church works. The *responsorium* in the office for the dead, and those in matins during Holy Week, have been elaborately treated by many masters. Several fine examples are to be found in Proske's "*Musica Divina*," vol. iv.

REST, in music, a character denoting silence; a cessation of sound equal in duration to the note represented by the rest. These rests have the following forms:—



Each of these rests is double the length of the one next following it. The invention of rests was almost contemporary with the invention of notes; in fact it became self-evident as soon as the length of notes was fixed, and not left to the fancy of the singer, that the pauses which the singer had previously managed at his own will and convenience must be also indicated. The old notes *marim*, *long*, and *short* (or *breve*) had the following rests:—



Here we see how the semibreve rest originated, namely, as the "superior" half of the breve, the minim being the "inferior" half. The crotchet rest originated in a slender breve rest with a slanting hair-stroke to the right; the quaver similarly, but with the slanting hair-stroke on the left.

It is sometimes the case that the breve rest is used to express silence during two bars, and the long (imperfect) rest to express silence during four bars; and it is now quite customary to use the semibreve as a bar rest whether there be two, three, or four breaks in the bar, and of whatever value these beats may be. A dot increases the value of a rest by half, as with the corresponding note.

Rests of more than one bar are now most often expressed by a thick horizontal line, over which the number of bars is written; thus:—

10

Rest of 10 bars.

The foreign names of rests sometimes give trouble to English readers. They are therefore subjoined.

(1) Semibreve rest; (2) minim; (3) crotchet; (4) quaver; (5) semiquaver; (6) demisemiquaver. French—(1) Pause; (2) demi-pause; (3) soupir; (4) demi-soupir; (5) quart de soupir. German—(1) Takt-pause (full-bar rest); (2) halbe-pause; (3) viertel-pause; (4) achtel-pause; (5) sechszehntel-pause. Italian—(1) Pausa della semibreve; (2) pausa della minima; (3) pausa della semiminima or pausa del quarto; (4) pausa della croma or pausa del mezzo-quarto; (5) pausa della semicroma or respiro.

REST, as a term in banking, means the sum left permanently in the banker's hands, and which the customer is by etiquette not permitted to draw upon. Some bankers decline customers who do not engage to leave sufficient rest—the Bank of England demands a rest of at least £300 on the part of all its banking customers, for instance; on the other hand a few banks will pay monthly interest upon the rest if it never falls below £100 during the month.

Rest is also a technical term appearing in the weekly returns of the Bank of England, denoting the balance of assets above liabilities. It is of the nature of a reserve against any contingencies that may arise. The rest was first organized in the year 1722, and was then quite small in amount. In the report of the bank published in September, 1886, the rest was £3,725,000.

RESTIACEÆ, an order of plants belonging to the *MOXOCOTYLEDONOS* and group *Glumaceæ*. There are 230 species, found for the most part in South-west Africa or Australia, very few in New Zealand, one in Chili, and one in Cochin-China. They form a hard, wiry, rush-like herbage.

The flowers are mostly dioecious, disposed in spicules, the glumes generally dry or rigid. The perianth is regular, with six segments, glumaceous, rigid, scarious or hyaline. There are three stamens in the male flowers. The ovary is one to three celled; the ovule is pendulous and orthotropous. The embryo is small, situated in albumen, remote from the hilum.

RESTITUTION (of stolen goods). By the law of England, if any person guilty of a felony or misdemeanour in stealing, converting, or receiving any property, shall be indicted for such offence by the owner or his executor, and convicted, the property is restored to the owner, and the court before whom the person is convicted has power to award writs of restitution for the property, or order it to be restored in a summary manner. If, however, it appears that any valuable security has been *bona fide* paid for, or being a negotiable instrument, has been *bona fide* taken or received by transfer or delivery by some person for a valuable consideration, without any reasonable ground to suspect that it had been stolen, &c., then the court has no power to order the restitution of such security.

In Scotland restitution is dealt with at common law much in the same way as under the English statute.

RESULTANT TONES, the name used by Professor Tyndall for what Helmholtz calls *COMBINATIONAL TONES*.

RETAINER, among lawyers, is a fee given to a counsel to secure his services, or rather, as it has been said, to prevent the opposite side from engaging them. A special retainer is for a particular case which is expected to come on. A general retainer is given by a party desirous of securing a priority of claim on the counsel's services for any case which he may have in any court which that counsel attends.

RETCHING. See *VOMITING*.

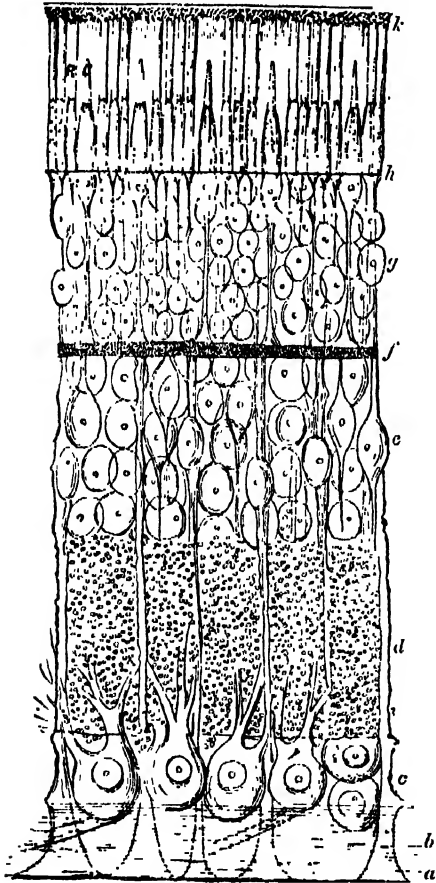
RETENE, a hydrocarbon polymeric with benzene. It is found native in beds of lignite or fossil pine stems in Denmark. It occurs in shining scales, melting at 98° C. (208° Fahr.), and boiling at a high temperature, distilling unchanged. It is insoluble in water, but soluble in alcohol, ether, and oils. It burns with a bright smoky flame. The formula is $C_{18}H_{12}$. Strong sulphuric acid converts it into disulphoretic acid ($C_{18}H_{12}S_2O_6$).

RET'FORD, EAST, a municipal borough of England, in the county of and 26 miles N.N.E. from Nottingham, and 138 from London by the Great Northern Railway, is situated on the east bank of the river Idle. The village of West Retford is connected to East Retford by a bridge. The town consists of several streets. It contains a handsome town-hall, including a corn exchange and poultry market. There is a large and handsome parish church of various styles of architecture, with a lofty tower. The grammar school was remodelled by the Court of Chancery in 1858. Its industries include paper-making, ironfounding, coachbuilding, and tanning, and it has an extensive trade in horses, cattle, cheese, pork pies, and hops. The municipal borough is governed by six aldermen and eighteen councillors, including the mayor. In 1881 its population was 9748. The town is supposed to take its name from a ford over the Idle, the waters of which assume a red tint after heavy rains. It is mentioned in the Domesday Book as "Redeford." In the thirteenth century it was called "East Reddford," when it sent members to Parliament. It returned two members to the House of Commons until 1885, when it was merged in the county.

RETIARIUS, the net-fighter (Lat. *rete*, a net), a famous variety of gladiators, armed with a trident and a net, the latter serving to entangle their foe, the former to

attack him and to despatch him, if the popular verdict should decree his death. As the retiarius was entirely without armour, and had no means of defence, his only chance lay in disabling his adversary by the throw of his net: if this failed he took to flight, and tried to prepare for another throw, in which he rarely succeeded. In consequence of its great risk this was a favourite gladiatorial game with the cruel Roman patrons of the amphitheatre.

RETINA. The retina, which is the actual seeing part of the eye, the eyeball and its lenses being merely the apparatus for condensing the light upon the retina, is a perfectly transparent membrane lining the back of the interior of the eyeball, and varying in thickness from $\frac{1}{10}$ to $\frac{1}{15}$ of an inch. With a little trouble it may be detached from an ox's eye which has been opened, and floated upon water as an exceedingly thin film. A section through it, avoiding the yellow spot and the blind spot (entrance of the optic nerve), presents under the microscope the appearance shown in the illustration. Here *a* is the surface



Section of the Human Retina.

nearest the light, and upon this the optic nerve ramifies countless filaments (shown at *b*), but the seeing portion the retina is at the back, furthest from the light and contact with the eyeball, the exact connection between the region (called that of the rods and cones) and the nerve filaments being as yet unascertained. Next to the region of the optic nerve-filaments (*b*) comes *c*, the layer ganglionic corpuscles, separated by a molecular layer, through which the filaments of the corpuscles pass. In the region *e* these filaments connect with an inner-layer

of nucleated granules, separated by the intergranular layer *f* from the similar but far more crowded outer-layer of nucleated granules. All this part, from *b* to *h*, is held together by fine connective tissue. At *h* begin the remarkable structures, *i*, called the rods and cones, and the connective tissue ceases; and *k* is the back of the retina, in contact with the black choroid coat of the eyeball. The latter is what we see when looking into the pupil of the eye, through the various transparent structures of the eye, and the transparent retina at the back of them, to the blackened eyeball beyond. The rods are seen to be more numerous than the cones, in the proportion of at least two to one. There are found to be no rods and cones in the blind spot, the entrance of the optic nerve into the eye; and on the contrary, in the yellow spot, the centre of the retina, where vision is most acute, the cones multiply immensely, almost to the exclusion of the other elements of the retina. It is upon these and other considerations (such as those in the next paragraph) that physiologists regard the rods and cones as the specially seeing structures of the retina. Owls and other nocturnal birds have very few cones; mud-eels have none at all.

Purkinje's Figures.—If a candle flame be moved up and down near the outer side of the eye, so that the light enters the eyeball in a slanting direction, a series of diverging black lines on a red ground will be seen, called *Purkinje's figures*, from the name of their discoverer. These are the shadows of the tiny bloodvessels, ramifying through the retina in the region between *b* and *h*; and these shadows of objects within the retina itself (and behind the filaments of the optic nerve) are seen, because they fall upon the innermost layer of the rods and cones — another proof of the visual superiority of these structures.

Visual Purple.—It is asserted by some physiologists, but the fact is not yet regarded as beyond doubt, that the layer *i*, that of the rods and cones, is in life not colourless like that of the rest of the retina (from which it is not distinguishable after death), but of a purple-red colour. Professor Boll, who first announced this, assumed that this *visual purple*, as it was named, was continually being destroyed by the light entering the eye. Following Boll, Kühne, professor of physiology at Heidelberg, investigated the subject. He obtained several retine from frogs' eyes in the purple state, and exposed them to rays of sunlight after sifting them through a prism, so that the retine were acted upon some by one colour, and some by another. He found that the purple was bleached quickest by white light, and next quickest by greenish-yellow, after which yellowish-green, green, bluish-green, blue, violet yellow, orange, red, follow in succession. Thus precisely those rays which we feel to be most dazzling (the greenish-yellow) are those which have most action on the visual purple. Further, Kühne renewed the purple in a bleached frog's retina by putting it into contact with the pigment layer of the choroid coat. He made a frog look steadily for fourteen hours at a blue light, and upon dissection it was seen that a correct image of the flame was photographed upon the retina as a colourless image on the deep red ground of the visual purple. One of Kühne's difficulties is, that the layers *b* to *h* of the retina become opaque after death, and thus he has to overcome by inverting the retina for the purpose of observation of these retinal photographs. Upon this theory the eye resembles a perpetually renewable photographic plate, destroyed by the intensity of the light at every moment as soon as the image has been recognized by the brain, and as swiftly renewed by the vitalizing power of the underlying choroid pigment.

RETORT, a chemical vessel in which distillation or decomposition is effected by the application of heat. For different purposes retorts are made of glass (fig. 1), earthenware, and metal; and the form varies according to the mode in which the retort is to be used.

In general, when the application of the higher temperatures is required for distillation or decomposition, earthen retorts are employed. In preparing hydrofluoric acid lead

Fig. 1.

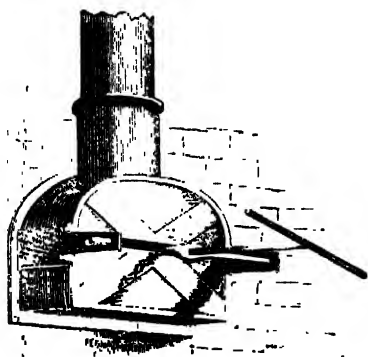


Ordinary Glass Retort used in Chemistry.

is used; and in concentrating sulphuric acid platinum is the best material for the retort.

Gas retorts were formerly constructed of iron, but these have latterly been almost entirely superseded by those

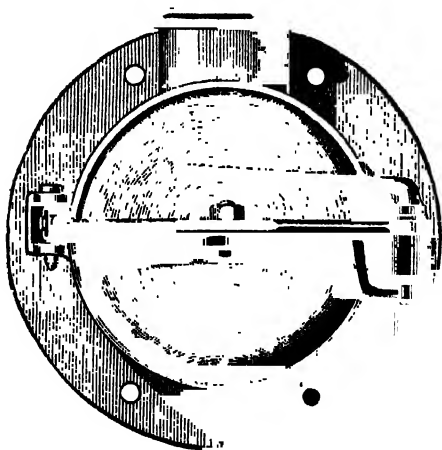
Fig. 2.



Mouthpiece of a Single Gas Retort.

made of fire-clay, which, while cheaper in the first instance, admit of a temperature being used which would prove rapidly destructive to such an oxidizable metal as iron.

Fig. 3.



Mouthpiece with a Merton Lid.

The "life" of a clay retort, or the time which it will last in active work, is about three years, while an iron retort seldom lasts more than a year.

Retorts as now used are of two kinds—viz., those termed "single," which have an average length of about 8 feet 6 inches, with an internal diameter of about 14 inches, and those termed "through," which with the same internal diameter have a length of from 18 to 20 feet. The single retorts have one end closed, the other end having a mouth-piece, while through retorts have a mouth-piece at each end. The mouth-piece of the retort (fig. 2) through which the charge is introduced and withdrawn, is invariably constructed of iron, being attached to the retort by means of iron bolts and cement. The mouth-piece carries the ascension pipe, which is fitted to it by means of a socket joint. In the ordinary lids a gas-tight joint is obtained by means of luting; the lid itself being pressed down tight into the retort mouth by a screw and crossbar. In a variety of lid (the "Merton" lid) which, from its greater convenience, has come much into use of late, a gas-tight joint is obtained by making the metal surfaces of the mouth-piece and lid so true that the pressure of a lever insures a perfectly gas-tight union (see fig. 3).

RETRENCEMENT, in fortification, is a work constructed within another, in order to prolong the defence of the latter by impeding or preventing the formation of lodgments when the enemy has gained possession of it; or to afford protection to the defenders till they can retreat with safety or obtain a capitulation. In the latter respects the interior work is called by the French engineers a *Reduit*. See **FORTIFICATION**.

RETRIEVER is a kind of Dog employed by sportsmen in retrieving or bringing back dead or wounded game. Several breeds derived from crosses are used for this purpose. The largest is a cross between the Newfoundland dog and the setter. It is a large dog, standing nearly 2 feet high, with a stoutly-built body and strong limbs. The hair is moderately long and curly, and usually of a black colour. Smaller breeds are derived from crosses between a terrier, either the smooth-haired English or the rough-haired Scotch, and a water-spaniel, pointer, or beagle. Careful training is necessary with all breeds of retrievers. Spaniels can be taught to retrieve.

RETROGRADE IMITATION, in music. See **IMITATION**.

RETROGRADE MOTION, in astronomy. Motion backwards, as opposed to direct motion. In astronomy all motion from east to west is retrograde; thus the apparent motion of the heavens is retrograde, and the earth's diurnal motion, which causes it, is direct.

RETZ, CARDINAL DE (Jean François Paul de Gondy), was born at Montmirail in 1614, the third son of a noble house with large estates in Brittany. His uncle being Archbishop of Paris, an ecclesiastical career was chosen for him when quite a boy. His youth, however, was spent in most unclerical fashion. He has recounted, in his remarkable Memoirs, one of the most graphic and vivid presentations of the period, and as interesting and well-written a book as even French literature can produce, how he flirted and fought duels and gambled, and was successful as a young gallant. This, too, notwithstanding he was short in stature, near-sighted, awkward, and "deliciously ugly." As he grew older, however, without leaving his worldly career, he aimed at distinction in serious literature, and with such success as to alarm Richelieu, who steadily excluded him from all preferment, with the remark, "Voilà un homme dangereux." After the death of Louis XIII. the queen dowager, Anne of Austria, appointed him coadjutor to his uncle the Archbishop of Paris, with the promise of the archbishopric in good time (1643). De Retz at once set to work to ingratiate himself with the middle class of Paris, and was soon one of the most popular men in the city, a favour he gradually began to use against Cardinal Mazarin, the prime minister. He not only joined that curious Opposition called the *Fronde*

(1648), but he may rather be said to have been the heart and soul of it. The object of the movement, if it had any other object than to change one ministry for another, was to change the absolute autocracy begun by Richelieu, and carried on by the queen and Mazurin, for a more general government, perhaps on aristocratic or oligarchical principles. But even this principle, such as it was, the Frondeurs held to very slightly, and the whole movement became a farce of intrigue. De Retz tried at the last to make friends in both parties, and, as he well deserved, came very near to utter failure with both. However, by a lucky accident, a pure mistake on the part of the Pope, he was named cardinal. Then the Fronde broke up, and he was thrown into prison (1652). He escaped to England, whence he went to Rome, and with his wonderful aptitude for intrigue had a great share in the election of Alexander VII., who in gratitude procured his forgiveness by Louis XIV. in 1662. Louis sent him as envoy to Rome, &c., but accepted, as the price of the cardinal's submission, the abandonment of all claims on the archbishopric of Paris. De Retz's stormy life passed henceforth into calm, spent chiefly in retirement in Lorraine. His debts were enormous, and it must be put to his credit that, protected as he was as an ecclesiastic, he yet voluntarily gave up all his income to his creditors, save only 20,000 livres annually, on which he lived the last years of his life. He died at Paris in 1679.

De Retz was a friend of Madame de Sévigné, and an enemy of La Rochefoucauld, and to the opposite sentiments aroused in each case we owe some fine touches of portraiture, with himself for their subject. The duke hit him off to the life when he said, "He stirred up the greatest dissension in the state without any settled plan as to what he meant to do with the result." Intrigue for intrigue's sake formed the staple of De Retz's life. He was, nevertheless, a remarkable man, and would have doubtless done well if Richelieu had not been prejudiced against him too much, and had made use of him and trained him to responsibility. His famous *Memoirs* were written about 1670, and partly published in 1717, but not properly edited till 1836. They are a source of perennial amusement, and as dramatic in parts as a novel.

REUCHLIN, JOHANN, also known by his Grecized name of *Cyprio*, a learned German Hebraist, was born in 1455, at Pforzheim, in the dominions of the Margrave of Baden, who having observed his aptitude for learning, sent him to Paris in 1473, as companion to his son. At Paris he prosecuted his Greek studies. In after life we find him successively at Basel, Orléans, Poitiers, and lastly Tübingen, where, having previously taken his degree in law, he commenced practice as an advocate about 1481. In 1482 he visited Rome and other of the chief towns of Italy, as secretary to the Count of Württemberg, and was received at the court of Lorenzo de' Medici with distinguished respect. On his return to Germany he took up his abode at Stuttgart; and from 1484 to 1509 filled a variety of high legal and diplomatic functions. In the troubled times which followed the commencement of the Reformation, Reuchlin had his share of distress and poverty. In 1518 he accepted, and held for a short time, the Greek and Hebrew professorships at Wittenberg; and he afterwards taught Greek and Hebrew at Ingolstadt for somewhat less than a year. In 1520 or 1521 he was appointed to the same chairs at Tübingen, a pleasant gleam over the close of his troubled life: crowds of students from all parts of Germany testified the respect in which his name and learning were held. He died at Stuttgart on 30th June, 1522.

As a scholar his name stands high among the men of his age, and he is regarded by the Germans as one of the fathers of their erudition, and as one of the earliest of their more advanced thinkers. He never separated himself from the Roman Church, but by his writings and personal

influence he did much to prepare the way for the Reformation under Luther, to whom he introduced Melancthon.

RÉUNION, formerly **BOURBON**, an island of the Mascarene group, forming a French colony in the Indian Ocean, is situated 100 miles south-west of Mauritius, and 400 miles east of Madagascar. The island is 128 miles in circumference, its extreme length being about 48 miles, and breadth 34 miles. It covers an area of 721,314 acres.

Réunion is supposed to have been discovered by the Portuguese about 1513, and figures on a map dated 1527, under the name of Santa Appolonia. It was claimed by the Dutch in 1598, at which time they occupied Mauritius, and was ceded by the Cardinal de Richelieu to the French Compagnie des Indes in 1642, from which date till the year 1810 it remained in their possession. It was captured by the English in the latter year, but finally restored to the French in 1815.

The island is composed of two groups of mountains running from east to west, some being of considerable altitude. The Piton des Neiges rises to a height of 10,200 feet, and, as its name denotes, is frequently covered with snow; and the Piton de Fournaise, a volcano still in action, has an elevation of 8000 feet. The island would seem to have been formed by, and to be in a fair way of being destroyed by, igneous action. The whole country shows marks of the most violent volcanic action, extinguished craters being met with on every hillside. The Piton de Fournaise is the only one at present in operation. The chief eruptions of the present century occurred in 1812, 1860, 1870, and 1881.

The island is furrowed by numerous torrents flowing from the mountains, which, during the rainy seasons, bring down vast masses of rock and debris; they are in no case of any use for purposes of navigation, and are for the most part dry, or nearly so, in the summer. Excellent mineral springs abound, but some are difficult of approach, and only available for residents during the dry season. The days and nights are about the same length during the year, which may be said to be divided into two seasons: the summer, lasting from May to October, a dry, cool season; and the winter, from November to May, wet and hot. The mean temperature in summer is about 22° C., and in winter about 26°.

Remarkable phenomena, very frequent and much dreaded on this coast, are the "raz de marin;" a heavy surf breaks on the land, whilst in the offing, and even in the roadsteads, the sea is perfectly calm. They are often more to be dreaded than hurricanes, which are sometimes very destructive, and on more than one occasion the greater part of the coasting vessels and boats of the island have been destroyed. Réunion was formerly said to be one of the healthiest places in the world; unfortunately this is no longer the case, the introduction of Asiatic immigrants having been attended with the appearance of various diseases previously unknown in the colony, but it is still by no means unhealthy.

The chief crop cultivated is sugar, introduced in 1711, with rotation crops of maize, manioc, peanut, and beans. Coffee, vanilla, tobacco, and cacao are also cultivated. The preparation of sugar for market, the manufacture of rum, the making of tapioca, and a small manufacture of perfumes are the chief industries. The coast regions are luxuriant in flowering plants and shrubs, and the banana, cocoa-nut, bread-fruit, guava, and tamarind are plentiful.

St. Denis, St. Pierre, and St. Paul are the only towns of importance. St. Denis is the seat of government. St. Pierre, a busy and thriving town of 28,000 inhabitants, concentrates the whole trade of the southern, and by far the richest, part of the island. There are no natural harbours, but St. Pierre has a small artificial harbour, which is in course of improvement. Porte de la Pointe des Galets, commenced in 1848, is planned to cover an area of

40 acres, and is provided with docks. A single narrow-gauge railway line, nearly 84 miles in length, extends round the greater part of the island, St. Denis being at about the middle.

The population is 170,000, of which about one-fourth were immigrants, and the remainder chiefly of mixed blood. The great need of the island is of labour, for whilst the whites cannot work under the sun, the creoles consider field labour degrading. The introduction of Indian coolies was regulated in 1881 by a convention between France and England.

REUSS, a principality in the interior of Germany, formed of two isolated territories that lie respectively in the upper part of the basin of the Saale and the Elster, and are disjoined by the intervention of the Weimar circle of Neustadt. The southern portion, consisting of the lordships of Greiz, Naumburg, Schleiz, and Lobenstein, lies between Bavaria, Saxony, Weimar, Schwarzburg, and Saxe-Meiningen. The northern part, which is drained by the Elster, lies between Altenburg, Weimar, and Prussia. The area of the whole is 410 square miles, and the population in 1883 was 161,126.

The country, especially in the southern part, is mountainous, being traversed by the Frankenwald, which rises to 2300 feet in height. There are many well-cultivated valleys, of which the two watered by the Saale and the Elster are the largest and most fruitful; also fine forests of pine and other timber, and rich pastures. The natural productions are some corn, fruit, hops, flax, and timber; horned cattle, sheep, game, and fish. The mineral productions are iron, copper, lead, some silver, alum, gypsum, vitriol, and salt. The inhabitants, who are almost all Lutherans, are principally engaged in rearing cattle and sheep, or in manufactures of linen, woollen cloth, calico, stockings, hats, earthenware, china, tobacco, alum, vitriol, beer, and iron.

The territory is divided between two lines of a princely family, the elder of which possesses only the lordship of Greiz, with an area of 122 square miles and a population in 1883 of 53,070. The chief town is Greiz. The younger line possesses Reuss-Schleiz, with an area of 318 square miles and a population in 1883 of 108,056. The chief town is Gera. The family of Reuss traces its descent to Henry the Fowler, who died in 936. Both principalities have constitutions and assemblies with restricted legislative powers, and since 1871 have been members of the German Empire.

REVEL or **REV'AL**, the capital of the Russian government of Esthonia, is situated on the Gulf of Finland, and in 1881 had 50,490 inhabitants. It is very strongly fortified, and in 1824 the harbour, which is one of the best in the Gulf of Finland, was made capable of receiving the Russian Baltic fleet. The roadstead is well sheltered by islands. The town and castle were founded by Valdemar II., king of Denmark, in 1218, and afterwards sold to the Teutonic knights. In 1710 the Russians took it from the Swedes. It was formerly the great emporium of the Hansatic League for the trade with Novgorod.

Revel is 230 miles W.S.W. from St. Petersburg. It contains some narrow irregular streets and dark old-fashioned houses. The best part of the city is the Dom, which is in fact a distinct portion, surrounded with walls and towers in the old style. It is on an eminence called the Domberg, on the west side of the city, commanding an extensive view of the sea. Most of the houses of the nobility are in this part. There are likewise two extensive suburbs. The principal public buildings are the cathedral, Lutheran, Roman Catholic, and Greek churches; a small imperial palace; the admiralty, town-hall, arsenal, collegiate episcopal seminary, several schools, a public library, theatre, naval and military hospital, club-houses, &c. The town has good warm baths, and is consequently much resorted

to as a watering-place. The manufactures are cotton goods, hats, stockings, leather, powder, starch, pins, needles, &c. There is also a cannon and bell foundry. The exports consist of corn, flax, tallow, spirits, &c.

REVELATION, BOOK OF. See **APOCALYPSE**.

REVENUE, PUBLIC. See **TAXATION**.

REVE'TMENT, in permanent fortification, is a wall of brick or stone retaining the mass of earth which constitutes the rampart, generally on the exterior side only, or retaining the earth which forms the opposite side of the ditch. The exterior faces of these walls are considered as the scarp and counterescarp of the ditch.

REVOLUTION. This well-known term is applied in astronomy to the manner in which a detached body moves round another, as a planet round the sun; but the motion of connected particles of matter round an axis, such as the diurnal revolution of a planet, is more usually called *Rotation*.

In pure mathematics the word *revolution* is applied to the angle moved over by a line which revolves round a point from any one position to that position again; it is therefore a synonym for four right angles.

REVOL'VER. See **SMALL ARMS**.

REYNARD THE FOX. See **RIKNEKE FUCHS**.

REYNOLDS, SIR JOSHUA, the founder of the English school of painting, was born at Plympton in Devonshire, 16th July, 1723; his father, the Rev. Samuel Reynolds, was master of the grammar school there. Being led, through the perusal of Richardson's 'Treatise on Painting,' to an enthusiastic desire to follow that art as his profession, his father placed him in 1741 with Hudson the portrait-painter, then enjoying a considerable reputation in London. Reynolds and his master, however, did not agree; they separated, and our young artist established himself as a portrait-painter at Plymouth Dock. After the death of his father in 1746 he settled in London.

In 1749 Reynolds made a voyage to the Mediterranean in the *Centurion*, then commanded by the young painter's friend Commodore Keppel. After a short stay in Minorca he embarked for Leghorn, and proceeded to Rome, where, while studying the frescoes in the Vatican, he caught a cold which was the cause of his after deafness, which never left him. Reynolds educated his mind rather than his hand at Rome; he did not copy the works of the great masters, but was content to study them. From Rome he went to Florence, Bologna, and Venice, and in the last city found the kind of magnificence most congenial with his own taste, in the splendidly coloured works of Titian and Paul Veronese. From Venice he went to Paris, and returned to Plymouth in the end of 1752; but by the advice of his early friend and patron, Lord Mount Edgecombe, he lost no time in settling himself in London. One of his first works of value was a portrait of the then Duke of Devonshire, but that which established his fame as the first portrait-painter of his country was a full-length of his friend Commodore Keppel. It was about this time that he contracted an intimacy with Dr. Johnson, which only ended with the death of the latter. In 1760 he purchased his house in Leicester Square, which became the centre of attraction of the most accomplished men of the time—Johnson, Goldsmith, Garrick, and Burke being among the painter's most intimate friends.

In 1761 the first public exhibition of works of art took place, in the room of the Society of Arts, in which Reynolds had four pictures; and in the exhibition of the following year he exhibited his portrait of Lord Ligonier on horseback (now in the National Gallery), and one of Sterne. In 1762 he painted his celebrated picture of Garrick between 'Tragedy and Comedy.' It was bought by the Earl of Halifax for 300 guineas. In 1764 Reynolds and Johnson instituted the Literary Club. Upon the foundation of the Royal Academy in 1768 Reynolds was unanimously chosen

president, and the honour of knighthood was conferred on him. In 1773 Sir Joshua painted his celebrated picture of Count Ugolino with his sons, from Dante; it was purchased by the Duke of Dorset for 400 guineas. In this year he was created Doctor of Civil Law by the University of Oxford, and about the same period was also elected a member of the Imperial Academy of Florence. In 1781 he painted his allegorical portrait of Mrs. Siddons as the "Tragic Muse." Upon the death of Allan Ramsay, this year, he was appointed principal painter-in-ordinary to the king. In 1786 he produced his "Infant Hercules strangling the Serpents in the Cradle," for the Empress Catherine of Russia. It was sent to St. Petersburg in 1789, and in 1790 the Russian ambassador presented him with a gold box having the portrait of the empress upon the lid, set with large diamonds. His executors afterwards received 1500 guineas as the price of the picture. Sir Joshua painted three pictures for Alderman Boydell's Shakespeare—the "Cauldron Scene" in Macbeth, "Puck" in Midsummer Night's Dream, and the "Death of Cardinal Beaufort." He died of a disease of the liver, 23rd February, 1792, and was buried with great pomp in St. Paul's Cathedral.

Sir Joshua Reynolds was never married; the principal portion of his large property, amounting to £80,000, was left to his niece, Miss Palmer, who afterwards married the Earl of Inchiquin, subsequently created Marquis of Thomond. Though Reynolds was a painter of a high order he certainly did not justify the extravagant encomium of his biographer that "to the grandeur, the truth, and simplicity of Titian, and to the daring strength of Rembrandt, he has united the elateness and delicacy of Van Dyck." His drawing is often incorrect and slovenly. He is further distinguished as a writer on art; his "Fifteen Discourses," delivered on various occasions at the Royal Academy, have appeared in various editions and in several languages. A magnificent illustrated edition was published by John Bury (London, Carpenter, 1812). His literary productions besides his discourses are—three contributions to the *Idler*; some notes to Mason's translation of Du Fresnoy's "Art of Painting;" and his "Notes" on his tour through Flanders and Holland in 1781. They are published in the complete editions of his works, printed for McLean in 1831 and Bohn in 1846. An elaborate "Life" by Northcote was published in 1819, and another has appeared lately by Mr. William Cotton—"Sir Joshua Reynolds and his Works," edited by J. Bury (1856); followed in 1859 by Sir Joshua's "Notes and Observations," &c., by the same author.

RHADAMAN'THOS, one of the judges of the dead in the Greek mythology, was the brother of the great lawgiver, King Minos of Crete, and his colleague in that kingdom. His inflexible justice made him so admired that Minos grew jealous of the preference of his subjects for his brother, and Rhadamanthos retired to Boeotia. At his death Pluton (Pluto) appointed him judge of Asiatic souls, Aiaikos being named judge of the Europeans. When they differed, Minos, the third judge, had a casting vote. The chief characteristic of Rhadamanthos is preserved in the epithet, "Rhadamanthine justice" (i.e. inflexible or rigid justice), which ought not properly to be held to mean, as it often seems to mean in some writers, merciless severity.

RHÆTIC BEDS, in geology, a series of marine deposits, only represented in England by the comparatively thin accumulations which form the PASSAGE BEDS between the KEUPER marls and the LIAS. They are most typically and extensively developed to the north of Italy, and in this country they are the representatives in time of the British lacustrine Keuper marls and sandstones; they are so called from *Rhætia*, the ancient name of Lombardy. In England these rocks extend as a narrow band, varying from 30 to 100 feet in thickness, between the Keuper and the Lias, from Dorsetshire to Yorkshire, and there are

excellent exposures along the shores of the Bristol Channel. The White Lias, seen at Lyne Regis, is also referable to the same age, and it is from the equivalent bed in the Bristol area that the well-known *landscape stone* or *Cotham marble* is obtained. Fossils are abundant at many horizons, and include remains of mammalia, reptiles, amphibians, and fishes, in addition to innumerable invertebrata. The most prominent molluscs are the bivalves, *Aricula contorta*, *Pecten calomienensis*, and *Arxius elongatus*; among fishes, the most interesting fossils are the teeth of *Ceratodus*—a mud-fish now confined to the rivers of Queensland, Australia—and numerous spines and teeth of hybodont sharks; the reptiles include the earliest known evidence of *PLEIOSAURUS* and *ICHTHYOSAURUS*; while the mammalia hitherto are only known to be represented by detached teeth of Microlestes. The vertebrate fossils are mostly obtained from a bone-bed at Aust Cliff, near Bristol, and from a similar thinner seam near Axmouth, in Devonshire.

RHAMNA'CEÆ, an order of POLYPETALÆ, and group Dicotyloræ. They are remarkable for having a valvate calyx, hooded petals, opposite to which their stamens are inserted into the tube of the calyx, and a superior or half-inferior fruit, which is either dry or fleshy. The species, about 430 in number, are all shrubs, with small greenish or inconspicuous flowers. Those most common in this country are the *Rhamnus Frangula* (black alder), *Rhamnus catharticus* (BUCKTHORN), *Palmus aculeatus* (Christ's thorn), and the evergreen *Alaternus*, also a kind of *Rhamnus*. The useful species are of some importance: *Rhamnus catharticus* and several others have purgative berries; *Rhamnus infectoria* yields the French berries of the shop, employed for dyeing yellow; the fruit of the Jujube (*Zelaphus jujube* and *vulgaris*) is subacid and eatable, and these species are therefore cultivated in the south of Europe and the temperate parts of Asia; *Hocnia dulcis*, a Chinese plant remarkable for its excellent red pulp; and *Rhamnus Frangula* is extensively cultivated for the manufacture of charcoal.

RHAM'NOCATHAR'TIN or **CATHAR'TIN** is a bitter principle obtained from the berries of the buckthorn, *Rhamnus catharticus*, natural order Rhamnaceæ. It is a yellow uncrystallizable substance, very bitter, and soluble in water and in alcohol, but insoluble in ether. Cathartin is a violent purgative, but is too uncertain and dangerous to be used in medicine. These berries also contain rhammannic acid, which precipitates salts of iron olive green, and a yellow substance called rhamnin. It crystallizes in needles, is soluble in alcohol, but insoluble in water and in ether. The formula is $C_{22}H_{16}O_9$. It is employed in dyeing yellow, especially for morocco leather, and forms the pigment known as sap green.

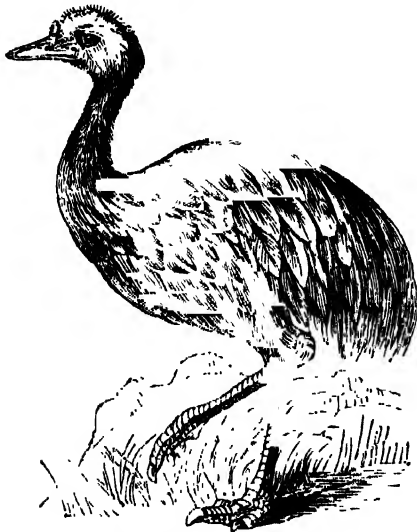
RHAMPSINITOS is the Greek name given to one of the ancient Pharaohs of Egypt, said to be the predecessor of Cheops (Khufu), the builder of the Great Pyramid. Herodotus tells of him that he had enormous wealth, and to contain it built a treasury, the stone walls of which were of incredible strength and thickness. The builder, however, contrived that one stone should be removable, and thus he could obtain access to the treasure. On his deathbed he communicated his secret to his two sons, and they continued to plunder the treasure. Finally the king discovered that his treasure vases were being opened; yet that the seals upon the door were unopened. He saw that the thieves must know another entrance, and therefore set traps round the treasure. One of the thieves was caught at his next visit, and at once giving up himself for lost he besought his brother to cut off his head, so as at least to save himself, lest otherwise he should be recognized or should by tortures be compelled to divulge his name. The king, relying upon the veneration of the Egyptians for their dead, hung up the headless body with insult, thinking that

he should find some one lamenting over it and so discover the thief. But the surviving brother made the guards drunk, and so safely obtained the corpse for burial. He also evaded other stratagems whereby the king sought to entrap him, and finally Rhampsinitos, seeing that he had to do with an exceedingly clever antagonist, promised him a free pardon by proclamation and great rewards besides. The man then came forward, and so pleased the king upon acquaintance that he gave him his daughter in marriage and advanced him to great posts in the government, "accounting him the most knowing of all men; for the Egyptians are superior to all others, but he was superior to the Egyptians" (Herod. "Enterpe," 121). Legends of this same king also exist which tell of a descent to Hades, and presents received by him from the infernal deities. As he was proverbial for his extreme justice, this seems to point to some kinship with the myths of Rhadamanthos, Aiklos, &c.

Bunsen considers that he has identified Rhampsinitos with Ramessu (or Ramses) Neter-kek-pen of the twentieth Egyptian dynasty.

RHEA. See CYBEE.

RHEA is a genus of birds belonging to the order STRUTHIONES, differing from the OSTRICH (*Struthio*) in having three toes upon each foot, by the head and neck being clothed with feathers, and by the total absence of tail-feathers; the wing-plumes are also far inferior to those of the ostrich. The Common Rhea, Nandu, or American Ostrich (*Rhea Americana*) was formerly found in great abundance on the plains of South America, from Paraguay and Brazil nearly down to the southern extremity of that continent, but from the thousands killed every year for the sake of the feathers its total extinction seems to be only a question of time. It is generally seen in pairs, but often in small flocks. Its food consists of roots, grass, &c., and also of small fish washed up on the mud banks of rivers. It is shy, wary, and fleet, preferring to run against the



Darwin's Rhea (*Rhea darwini*).

wind. It takes freely to the water, and swims with ease across rivers having an even, rapid current. The note uttered by the male is a deep-toned hissing. It appears that the male alone incubates the eggs, and that several females lay in one shallow excavation, the total number of eggs varying from twenty to fifty; and besides the eggs deposited together in the nest, others are found scattered in great numbers over the plain. The rhea is hunted on horseback,

and captured either by means of the lasso or by throwing at its legs an instrument composed of two large balls or heavy stones united by a long leathern thong. The rhea is about half the size of the ostrich. The feathers of the upper part of the body are ash-coloured, tinged with brown; the head and neck are dark brown, with the crown and nape dingy white; the breast is dark brown, and the belly and thighs white. The eggs are yellowish-white in colour. The wing-plumes are employed in the manufacture of light brooms. Like the ostrich, it is capable of domestication. Darwin's Rhea (*Rhea darwini*) is a considerably smaller species, inhabiting Patagonia, especially the southern portion. It differs from the common species in having the bill shorter than the head, and by the tarsi being reticulated and their upper parts feathered instead of being bare. The feathers of the body and wings have a whitish band at their tips. According to Darwin, the eggs are a little smaller than those of the common species, of somewhat different form, and with a tinge of pale blue. In its habits it resembles the nandu. A third species, the Long-billed Rhea (*Rhea macrorhyncha*) has been found in North-eastern Brazil, but its exact range is not known. It differs from the nandu in having a longer bill, more slender tarsi, and shorter toes; and the general colour of the plumage is darker.

RHEA SILVIA. See ROMULES.

RHEA FIBRE, a valuable fibrous material, procured from one of the nettle tribe, belonging to the order URTICACEÆ, and the genus *Boehmeria*, which differs little from the true nettles, except in that its species have no stinging hairs. The plant, which is herbaceous and perennial, is a native of China, and has long been cultivated also in India, Japan, Sumatra, Java, Siam, Burma, Assam, and other countries in the same part of the world. The Malayan name for it is Ranic. It has been introduced into America, and is largely cultivated in Louisiana and the Gulf States, where, from rich, deep, moist, and well-drained soils, three crops per year are produced. The fibre is not in any sense new, though its value has not been generally and duly appreciated. It first became known in this country in consequence of the occasional importation of the beautiful fabric called China grass cloth, which is made from it. In this country it is used as a substitute for silk, and enters largely into mixed dress goods having a "silk finish"—brilliant, durable, and useful fabrics which have attained considerable popularity, and for which there is also a great demand in the United States.

In strength rheca is very superior to either flax or hemp, while in another particular it excels almost all known fibres—namely, the power of resistance to the influence of moisture, by which many fibres are most injuriously affected. Notwithstanding their great strength the fibres of rheca are as fine as those of flax, while they possess a silky lustre with which flax can in no way compare. Indeed, in gloss and fineness rheca resembles silk, and, as already observed, is largely used as a substitute for it; while in its remarkably hairy nature it approaches the character of wool, as a substitute for which it is also very successfully used. The high price of rheca prevents its competing economically with cotton, and for the same reason it can only vie with the finest descriptions of flax or hemp. Its peculiar glossy and hairy nature gives it a sort of intermediate position between the animal and vegetable fibres—silk and wool; and when some difficulties of manipulation are overcome, and the cost of rheca is thus reduced, the fibre will doubtless be substituted for a multitude of the common purposes for which flax and hemp are now used.

Dr. Roxburgh, author of "The Plants of Coronandel," who devoted his attention most earnestly to the useful plants of India, gave the rheca plant the name of *Urtica tenacissima* (now known as *Boehmeria nivea*), on account

of its exceeding in strength all fibres he had previously examined. He brought the fibre under the notice of the court of directors of the East India Company as far back as 1816; and they, after due examination, declared this fibre to be stronger than Russian hemp of the best description; and to have been brought to a thread preferable to the best material in Europe for Brussels lace. It may seem surprising that for many years after the fibre had been thus strongly commended, and by so high an authority, almost nothing was done towards its introduction into the United Kingdom for manufacturing purposes. But this has been the case as to other fibres—jute, for example, which is now so largely used, especially in Dundee.

From three to six crops are obtained in tropical countries in good situations, the most suitable being those which are moist and at the same time shady. The crop of fibre yielded is not as great as that produced by jute, but still it is very large, often as much as 250 lbs. per acre. It can also be grown in temperate climates, but the yield is not so great. In the East the methods of extracting the fibre are primitive. When the stalks are cut down they are stripped of leaves and branches and the outer cortical tissue. The remainder of the stalk consists of a woody core surrounded by the fibrous layer, which contains a great deal of gummy and resinous matter. The stalks are submitted for some time to the alternate action of sunshine and dews, until the fibres can be easily detached from the wood. Boiling water is then used to get rid of gum and resin, and finally the fibres are bleached in the sun. The Americans take the stems as they come in sheaves from the fields, and at once subject them to the action of machinery, by which they are crushed and scraped, and the fibre is turned out clean.

In 1885 MM. Frémy and Urbain of Paris invented a method of treatment with alkaline solutions, varying with different qualities of fibre, which gets rid of resinous matter and produces a pure fibre of long unbroken staple, some of the fibres being 11 inches in length. In connection with this process M. Favet has invented a simple machine in which the stems, as soon as they are gathered, are submitted to the action of low pressure steam in closed wooden troughs for about twenty minutes. The cortical and fibrous layers are then peeled off the woody core in long ribbons, which can easily be done by children. This machine is adapted for use in the East, whence the ribbons can be sent home for the extraction of the fibre by the Frémy-Urbain method. The machines for spinning the thread are, however, still a thing to be desired.

RHEGIUM. See RIGGIO.

RHEIMS (Fr. *Réims*, pronounced *Rannee*), a city in the department of Marne, France, stands on the right bank of the Vesle, a feeder of the Aisne, 81 miles east by north from Paris, which had 93,683 inhabitants in 1881. It is mentioned by the name of *Durocortorum* by Julius Cæsar in whose time it was the capital of the Remi. At a later period it took the name of Remi, from the people to whom it belonged. Under the Roman Empire it was the capital of Belgica Secunda, and became distinguished by its literary character. The city embraced Christianity in 360, and soon after gave title to a bishop. In 494, after the defeat of Syngrius at Tolbiac, it was occupied by Clovis, who, with his Frankish lords, received baptism here in 496 at the hands of St. Remi, then bishop of Rheims. In 744 the see was raised to an archbishopric. In 1179 it was signalized by the consecration of Philippe Auguste; and all the succeeding sovereigns of France down to Charles X inclusive (1830), were consecrated here, with the exception of Henry IV., Napoleon I., and Louis XVIII. In 1359 the city was blockaded for seven months by the English, who were at last forced to raise the siege; it submitted to them in 1421, but they were soon driven out by the Maid of

Reims. In 1814 it was taken (12th March) by the Russians, but retaken next day by Napoleon. It is renowned in the history of the middle ages for the maintenance of its liberties against the bishops. Before the revolution of 1793 it had a celebrated university, and many councils have been held here. Colbert, Gobelins, and Languet were born at Rheims. Rheims was occupied by the Germans on their march to Paris, in 1870, and was for some time the headquarters of their army of occupation after he war.

The town, which is in general well built, is situated in a vast basin surrounded by chalk hills, on which good wines are produced. It is now defended by detached forts. The old ramparts form a very agreeable public walk. They enclose within their circuit many large gardens and squares. The town is supplied with water raised by a hydraulic engine from the Vesle to a reservoir outside the walls, whence seventeen fountains in different quarters of the city are fed. The streets are wide, well paved, and neatly laid out. The houses are for the most part built of chalk, or of boards covered with slate; some of them present their gables to the street; in others the upper storeys project, and, being supported on wooden columns, form on the ground-floor a covered walk or gallery. The old Place-Royale is a regular square, surrounded by good houses or public buildings of mingled Greek and Italian architecture.

The most striking public building is the Cathedral of Notre-Dame, one of the finest Gothic edifices in Europe. It was commenced in 1210 on the site of a more ancient church, which had been destroyed by fire, and was opened for divine service in 1241. The entire length of the interior is 466 feet, the breadth 99 feet, and the height 144 feet. The west front, which is surmounted by two square towers that rise to the height of 267 feet, is pierced by three magnificent arched doors decorated with a profusion of statues, bass-reliefs, and other ornaments, of exquisite workmanship. Over the principal doorway is a splendid rose window of stained glass. The shafts of the flying buttresses, surmounted with statues, the rose-windows over the side door-ways, and the Angel tower, a remarkably light bell-tower rising 59 feet above the roof of the church at the eastern end, surmounted by a ball and by the statue of an angel from 7 to 8 feet high, are all worthy of attention. The interior of the church is also very striking from the vast extent of the nave, the splendid stained-glass windows, the side chapels, the pavement of the choir, inlaid with marble of various colours, the ancient baptismal fonts, the organ, and the fine paintings and tapestry that adorn the walls. The ancient tomb of Flavius Jovinus, a native of Rheims, who held a high office in Roman Gaul and embraced Christianity in 366, was transferred from the ruins of the old church of St. Nicaise in 1800 to the right of the nave of the cathedral.

The Church of St. Remi, the most ancient in the town, dates from 1041, and is almost as large as the cathedral. The interior is remarkable chiefly for the tomb of the saint, an elaborate piece of workmanship, erected in 1803, partly from the remains of the more ancient one destroyed in 1793. The other remarkable buildings are—the town-hall, completed in 1825, and containing a library of 60,000 volumes and 1500 MSS.; several ancient hotels and other houses, many of which are marked with inscriptions commemorative of important events, as the Maison-Rouge, in which the father and mother of Jeanne d'Arc were entertained in 1429; the house called Long-Vêtu in the Rue de Cérés, in which Colbert was born, &c.; and the Mars Gate, a triumphal arch erected in honour of Julius and Augustus Cæsar.

The manufactures are extensive; they consist of woollen cloth, kerseymeres, light stuffs for summer coats and trousers, swanskins, camlets, merinoes, cashmere shawls,

flannels, blankets, carpets, hosiery, bolting-cloth, cordage, candles, soap, and leather. Wax and wool bleaching, dyeing, wool-combing, brewing, and the making of machinery are carried on. The spiced bread and biscuits of the town are in great repute. The chief trade is in the above-named articles of manufacture, corn, flour, champagne wines (which are produced in large quantities in the vicinity, and of which it is a large depôt), brandy, spices, wool, cotton-yarn, flax, hemp, raw hides. There are four yearly fairs. A railway joins Rheims to the Paris-Strasbourg line, on which it abuts a little east of Épernay, and the Aisne and Marne Canal runs by the town.

Rheims has an assize court, a tribunal and chamber of commerce, a civil tribunal, an exchange, a council of prud'hommes, a national college and academy, two ecclesiastical schools, four hospitals (one of which, the Hôtel-Dieu, occupies the building formerly belonging to the Benedictine Abbey of St. Remi), two bathing establishments, and a large theatre.

RHEIN or CHRYSOPHANIC ACID is the yellow coloring matter of rhubarb, *Rheum palmatum*, natural order Polygonaceæ. It is also found in the common dock and in the wall lichen, *Parmelia parietina*. It crystallizes in yellow tables or in needles. It is scarcely soluble in water, more so in alcohol, but the best solvents are ether, benzene, and the oils. It melts at 162° C. (323° Fahr.) and again becomes crystalline on cooling. The formula is $C_{10}H_8O_6$. It gives a deep purple colour with alkalis, which is very characteristic; the reaction is delicate, and forms a test for the presence of alkalis. It is usually prepared from gœa powder or araroba, a concretion from the stem of *Andira araroba*, natural order Leguminosæ, a tree native to Brazil. This substance contains 80 per cent. of chrysophanic acid. It is much used in medicine, especially in the form of ointment for skin diseases. It is very valuable in the treatment of ringworm, as well as psoriasis and other forms of eczema; it has the disadvantage of dyeing the skin and clothes a deep brown, which is difficult to remove.

RHEIN'GAU, a district on the right bank of the Rhine, which forms the south-west portion of the ancient duchy of Nassau, and extends about 12 miles in length by 6 miles in breadth. Sheltered by lofty hills, and enjoying a fertile soil, it is famous for the admirable wines which it produces and the luxuriance of its crops. Hock, the wine, derives its name from Hockheim on the Main, in this district. The principal town is Elfeld.

RHEIN-KREIS (Circle of the Rhine), now the PALATINATE, a province of Bavaria, is entirely detached from the rest of the kingdom, and lies on the left bank of the Rhine. It was assigned by the Congress of Vienna to Austria, which made the country over to Bavaria. It is bounded N.W. by Rhenish Prussia, N. by Hesse, E. by Baden, from which it is separated by the Rhine, and S. by France, Rhenish Prussia, Coburg, and Hesse-Homburg; the area is 2235 square miles, and the population in 1881 was 677,281. The circle is very hilly, being traversed by branches of the Wasgau (Vosges); but there are some beautiful valleys and plains, which are very fertile and well cultivated. The higher mountains are for the most part covered with forests, the southern slopes with vineyards. The principal river is the Rhine. All the other streams are tributaries to it; the chief of these are the Lauter, which forms the boundary towards France; the Queich, the Speyerbach, and the Nahe. Agriculture has been brought to a high degree of perfection; the products are corn of all kinds, pulse, flax, hemp, tobacco, madder, and hops. Fruit is very extensively cultivated, and the inhabitants derive very large profits from the growth of walnuts and chestnuts. The best wines are produced near the Rhine. There are flourishing manufactures of wool, cotton, and hardware. Chief towns, Deux-Ponts, Landau, and Spire.

RHEN'ISH PRUSSIA or RHEIN-PROVINZ, though the latter name is more generally understood to include also the province of Westphalia, is situated on both sides of the Rhine, which flows through it for more than 200 miles, and comprises the old grand-duchy of the Lower Rhine, and the former duchies of Juliers, Cleves, and Berg. Except the circle of *Wetzlar*, which is encompassed by Nassau, Hesse-Darmstadt, and Hesse-Cassel, it is bounded N. by Westphalia, E. by Nassau and Hesse-Darmstadt, S. by France and Bavaria, and W. by Belgium and the Netherlands. It will be thus noticed that this province formed an outlying district of the Prussian kingdom until the incorporation of Nassau and Hesse in 1866.

The northern part is generally flat. The high lands commence on both sides of the Rhine, near Bonn, and extend southward. On the west side of the river lies the extensive volcanic district of the Eifel-gebirge, containing the Lake of Laach. The principal rivers besides the Rhine are the Moselle and the Lippe, which are navigable; the many smaller streams, most of which fall into the Rhine, are either not navigable, or only by very small vessels. The climate is temperate; the air on the right bank pure and healthy; on the left bank damp fogs are more frequent, especially in the north-west, where there are many marshes; on the mountains it is cold. The natural productions of this province are equally numerous and valuable. Some parts of the mountains are crowned with forests, and the declivities covered with vineyards where the exposure is favourable. The wine is much esteemed, and is the most important product of the province. The minerals are silver, iron, copper, lead, calamine, marble, slate, freestone, mill-stones, basalt, porphyry, alum, manganese, sulphur, coal, and salt. In the level parts of the north lie productive cornfields and rich pastures; between the mountains fertile valleys extend, where flax, hemp, hops, and tobacco are grown, and fruit and garden produce of every kind are cultivated in great abundance. Game is plentiful, and all the domestic animals are bred in sufficient numbers for the wants of the population.

All the great towns are provided with railway communication, a trunk line connecting the Prussian and Belgic railways, and crossing the Rhine at Cologne. The total area of the province is 10,289 square miles, and the population (two-thirds of whom are Catholics) in 1881 was 4,074,000. The capital is COLOGNE. The other principal towns are BONN, DUESSELDORF, EBERFELD, TRIER, CREFELD, COBLENZ, and AIX-LA-CHAPELLE.

RHEOMETER (Gr. *rhéa*, I flow, and *metron*, a measure), an instrument by which the force of a current may be measured.

The word was first proposed by M. Péclet as a synonym for galvanometer, or measurer of the electric current. The rheometer or galvanometer employed by Wheatstone is a glass cylinder resting on a stand, and containing within it a magnetized needle, which is suspended from the cover. A graduated circle serves to show the deviations of the needle from the zero of the graduations, and the amount of deviation is read by means of a microscope. For forces or resistances which are considerable, there are placed below the circle numerous coils of fine wire; but for small forces a thick plate of wire making but one coil is used.

Ludwig's Rheometer is an instrument for measuring the velocity of the arterial flow in the circulation of the blood. Essentially it consists of two glass chambers, which can alternately be connected with the artery and therefore alternately filled; while one is filling the other is emptying, and a quick reversing apparatus diverts the flow to the empty chamber as soon as the other is full. It is manifest therefore that the number of times this reversing apparatus is used measures the number of chambersful of blood sent out by the artery in any given time.

Instruments for measuring the flow of rivers, of glaciers,

&c., may also be termed rheometers, but the word is generally as yet restricted to the two senses given above.

RHEOSCOPE is an instrument used to test the presence and direction of a current. An electric rheoscope is now often termed a *galvanoscope*. A rheometer, whose function is to test the force of a current, is generally used as a rheoscope.

RHESUS MONKEY (*Macacus rhesus*), a species of *MACAQUE*, inhabiting Bengal and other parts of India. The Rhesus Monkey has a strongly built body, with a tail of moderate length, thick, and well covered with hair; the upper surface of the body is of a greenish-gray colour, the individual hairs being annulated with light dun and dark brown; the lower surface and the inside of the limbs are light gray, and the callosities are bright red. The skin is remarkably loose and flaccid, hanging in folds even in the young animals. The Rhesus Monkey or Blunder is sacred in some parts of India, and levies contributions upon the grain and fruits of the natives with impunity. It is remarkably intelligent, and is taught by the native jugglers to perform many amusing tricks.

RHETORIC. Various definitions have been given of the term rhetoric from the days of Aristotle downwards. That great philosopher defined it as an art which, upon every subject, considers the capability of persuasion; and regarded the finding of topics of persuasion, so far as respects the matter of what is spoken, as the true province of rhetoric, together with the consideration of style, arrangement, and delivery. Quintilian, however, in his "Institutes of Eloquence"—a practical, complete, and elegant work—finds fault with the above definition of Aristotle, because persuasion may lie in many things besides speech, and prefers to define rhetoric as the art of speaking well. "In the present day," wrote the late Archbishop Whately, with his usual exactness, "the province of rhetoric, in the widest acceptation that would be reckoned admissible, comprehends all composition in prose; in the narrowest sense, it would be limited to persuasive speaking."

In the present article we shall consider rhetoric as the art of persuasion—a definition which is said to have originated with the famous Athenian orator Isokrates, and is supported by more eminent authorities than any other. Certain eminent authors have written strongly against rhetoric as an art calculated to mislead and deceive, forgetting that it is illogical to argue against its use from the fact that it is occasionally abused by bad men. Thus Locke, in his "Essay on the Human Understanding," says:—"It is evident how much men love to deceive and be deceived, since rhetoric, that powerful instrument of error and deceit, has its established professors, is publicly taught, and has always been had in great reputation; and I doubt not but it will be thought great boldness, if not brutality, in me to have said this much against it. Eloquence, like the fair sex, has too prevailing beauties in it to suffer itself ever to be spoken against. And it is in vain to find fault with those arts of deceiving wherein men find pleasure to be deceived."

Empedoklēs is said to have been the first teacher of rhetoric among the ancients; but the earliest to lay down formal rules for it were two Sicilians named Korax and Thysias, who were followed by Gorgias. Periklēs was the first statesman to avail himself of the charms of ornamental eloquence. But Isokrates, supposed to have been a pupil of Gorgias, was the most famous of all the ancient rhetoricians; though, owing to being prevented by an unconquerable timidity from speaking in public, he did not exercise the same influence over public affairs as Periklēs, Demosthenes, and many of the other great orators of Greece, who "swayed the fierce democracy at will." His school of eloquence was the most celebrated in Athens, and was distinguished by the number, rank, and fame of its pupils. Like Gorgias, Isokrates attained to an advanced age, and

when he was in his eighty-ninth year Aristotle (Aristotelēs) first began to give lectures in rhetoric. It is needless to say what vast obligations rhetoric owes to that many-sided man; and his pupil Theophrastos also distinguished himself by his compositions on the same subject. Among the Romans, the writings of Cicero afforded the highest examples both of the precepts and the practice of eloquence. Quintilian was deservedly eminent both as a teacher of rhetoric and as a pleader, and was the first who obtained a salary from the state as a public teacher; and, as an instance of triumph over the difficulties of the subject, and an example of the possibility of imparting grace and elegance to the treatment of scholastic topics, which are in their nature as intractable as grammar or prosody, there is still no masterpiece in any literature greater than his "Institutes of Eloquence."

Quintilian divides a judicial pleading into five parts—a persuasive introduction or opening; a statement of the case or narrative; proof or evidence in support of the case; refutation of what is advanced by the opposite party; and a peroration or eloquent and forcible winding-up of the whole. He insists that no one can be a complete orator without being also a good man. "I require," he says, "that he should be not only all accomplished in eloquence, but possessed of every moral virtue." Yet the examples of Bolingbroke, Mirabeau, and many other great speakers would seem to prove that the highest oratorical power in political or legal speakers may coexist with inferiority in moral excellence. The moderns possess one species of eloquence, however, in which Quintilian's dictum is absolutely true, but this department of oratory was totally unknown among the ancients. We allude to the eloquence of the pulpit, carried to a high pitch of perfection in this country by Jeremy Taylor, Tillotson, South, Barrow, Robert Hall, and Chalmers; and in France by Bossuet, Massillon, Bourdaloue, Fléchier, and a number of other great preachers. In spite of its advantages from the dignity of its mission, the grandeur of the cause which it supports, and the complete possession of the field of debate for the time being, the attainment of supreme excellence in pulpit oratory is a matter of the utmost difficulty, as the small number of those who by general consent have attained to it is sufficient to prove. There must be burning zeal, and a soul consumed with the desire of doing good, guided by a masterly understanding and animated by a profound conviction. Like the advocate, the preacher often encounters obstinate and prejudiced hearers, whom he has to induce to act against the inmost affections of their souls and their dearest and most cherished habits, yet he may not, like the advocate, make use of every means of moving and gaining over his hearers. He cannot, like him, oppose vice to vice, and passion to passion, or make vanity, pride, ambition, envy, anger, or revenge act in his favour.

Elocution is that branch of rhetoric which relates to the wording of a discourse, and which teaches us how to compose with correctness, propriety, and elegance. Style has regard to the selection and arrangement of words; and the acquisition of a good style is of the utmost importance both to the writer and the speaker. On whatever subjects we write or speak, two qualities are essential to a good style—perspicuity and purity; and to these may be added ornament, the peculiarly rhetorical quality of style. We must begin by clearly understanding our subject ourselves before we can expect to make it clear and easy to the comprehension of others. Of all vices of style, with the exception of affectation, obscurity is the worst and the most inexorable. Perspicuity depends on exactness in the choice of words, accuracy in the construction of phrases, and logical precision in the connection of ideas. Purity of language may be destroyed in three different ways. First, by employing words which are not English, which is what grammarians term *barbarism*. Secondly, by the construction of a phrase

not being good English, although the words that compose it are so, and this is what constitutes a *solecism*. Thirdly, by the words and phrases being so selected and arranged as not to bear the meaning which they ordinarily bear, and this is termed *impropriety*. But besides purity, which is a grammatical quality, style may be considered as having for its object the understanding which it would enlighten, the imagination which it would impress, the passions which it would excite, and the ear which it would delight. And, regarded in these various aspects, it should be clear for the understanding, lively and animated for the imagination, strong and vehement for the passions, and various for the ear.

Different subjects demand different styles. The oratorical style, for example, would not suit a philosophical treatise. Hence the distinction into the *ornate* and the *concise* style. The concise writer compresses his ideas into the fewest words possible, employs only those which are most impressive, and rejects all which are not rigidly necessary to the development of his thoughts. If he ever makes use of ornament, it is to strengthen and not to embellish his work; and he never twice presents the same idea. Everything tends to precision, and he seeks rather to make the reader think, than entirely to satisfy his imagination. The ornate writer, on the other hand, extends the development and explanation of his thoughts. He presents his ideas again and again, until he has displayed them in all possible lights; and what he loses in force he strives to regain by abundance and variety. His periods are generally long, and he is prodigal of all the ornaments of which his subject is susceptible. As brilliant examples of these two different styles, we may point to the concise Tacitus and the ornate Cicero in ancient times, and to Burke and Gladstone respectively in modern days.

The student of rhetoric must not fail to study Aristotle, the first great master of the subject, whose treatise in many respects has never been superseded; and the other great classic, Quintilian, whose "Institutes of Eloquence" is still indispensable. Cicero's treatise is far beneath these in value, though not in interest. Modern works of importance are Campbell's "Philosophy of Rhetoric," and the late Archbishop Whately's treatise on the subject.

RHEUMATISM (Gr. *rheumatismos*, a defluxion), a febrile disease caused by certain obscure climatic and diathetic influences, and characterized by affections of the joints and external muscular tendinous and fibrous textures of the body. Although it is a very common disease, and one that has been under close observation for a long period, its essential nature is still unknown. Of the several important varieties of this disease the most serious is that known as *acute rheumatism* or *rheumatic fever*. The predisposing causes of this form of the disease include hereditary tendency, which can be traced in 27 per cent. of all cases; laborious outdoor occupations, in which persons are exposed to cold and wet; poverty with its attendant evils; and residence in certain districts having unfavourable climatic influences. The exciting causes of the disease are, in the majority of cases, exposure to cold and wet or the taking of a chill when heated, but where a tendency to this disease exists an attack may be induced by derangements of the digestive organs, or by any seriously depressing influence upon body or mind. It is rather more common among men than women, but the influence of sex is not considerable, and though the great majority of first attacks occur in persons between the ages of sixteen and twenty-five, it is not limited to any period of life, children and persons past middle age being occasionally victims to it. The early symptoms of an attack of acute rheumatism of an uncomplicated character are usually the existence of aching pains in the limbs and trunk, flying pains and stiffness in the joints, a general feeling of uneasiness and depression, with chilliness and perhaps soreness of the throat.

These are followed by heat, restlessness, thirst, and the other concomitants of fever, together with an acute pain in some of the joints—the wrists, shoulders, and knees being specially affected. The temperature is high, the pulse rapid, and the body soon becomes bathed in perspiration having a sour acrid odour, which is often so powerful as to enable a diagnosis of the disease to be made from it alone. The pain in the joints is of a shifting character, and it may pass rapidly from joint to joint, and return again, the affected parts being left swollen, red, and tender in the interval. There is also considerable disturbance of the digestive functions, the bowels being irregular in their action, the tongue coated with a thick creamy fur, the appetite disappears, and the thirst is greatly increased. Respiration is somewhat accelerated, and there may be a slight cough. The urine is scanty and high coloured, and is so loaded with lithates as to give rise to a copious red deposit on cooling. When the disease has become fully developed the patient lies in a helpless condition upon his back with every joint at rest and carefully guarded. His mind remains clear, but he is incapable of exertion, and his attention is chiefly directed to the maintenance of the affected joints in as easy a position as possible. His unsuccessful attempts to obtain relief render him restless and miserable, and when he succeeds in getting a little sleep he is liable to be suddenly aroused by sharp spasms of pain in the muscles connected with the affected joints. The duration of an attack is very variable, some persons getting over the acute period in five or six days, while others take as many weeks, the signs of recovery being the subsidence of the pain in the joints, a disappearance of the perspiration, a return of the appetite, the passing of a larger quantity of urine, and the restoration of the normal temperature. The joints remain stiff, feeble, and painful on movement for a time, but the soreness gradually disappears as convalescence progresses. Not unfrequently, however, acute rheumatism is complicated by an inflammation of the pericardium or membranous bag inclosing the heart, giving rise to the disease termed *pericarditis*; or the membrane lining the heart, or even the heart itself, may be inflamed, such complications being known as *endocarditis* and *myocarditis* respectively. Sometimes the lungs are affected, and there may be an attack of pleurisy, but this occurs less commonly than heart disease. Persons once attacked by acute rheumatism have ever afterwards a predisposition to it, and this susceptibility is increased with every successive attack, though it commonly happens that the second and third attacks are less severe than the first. Almost the only redeeming feature in this disease is that it is rarely, if ever, fatal by itself, and even when it is complicated by heart disease the patient usually recovers from the attack, though he may suffer afterwards from its remote effects.

With respect to the medicinal treatment of this disease no specific has been discovered up to the present, but among the large number of drugs which have been recommended *salicine*, a substance obtained from the willow, is that which has been found to yield the best results. Different forms of the active substance are preferred by different practitioners, 15 to 25 grains of salicylate of soda, 20 grains of salicylic acid, or 15 to 30 grains of salicine being administered every one, two, three, or four hours, until the pain is relieved and there is a reduction in the temperature. In cases where it is given quite at the commencement it sometimes quickly cuts short the attack, and where the disease has become developed its beneficial effects are usually apparent within twenty-four hours of its first administration. The average duration of acute symptoms under the salicylates is about three or four days, but unfortunately they sometimes give rise to unpleasant symptoms, such as deafness, noises in the ears, delirium, sickness, and depression of the heart, and convalescence appears to be more slow after treatment with them

Another method of treatment which still obtains considerable favour consists in the administration of alkalies in large and repeated doses until the urine has been rendered alkaline instead of acid; in maintaining this reaction as long as the rheumatic symptoms continue, and by gradually allowing a neutral or acid reaction to return by diminishing the dose as the disease declines. A modification of this method consists in combining quinine with the alkalies in somewhat large doses. Where the pain is very acute and exhausting, opium in the form of a hypodermic injection of morphia may be used as a palliative, but its effect must be carefully watched, and it probably exerts no influence on the progress of the disease. With respect to the nursing required, as acute rheumatism is not a contagious disease there is no necessity for isolation, but as it is usually prolonged and painful care should be taken to procure as much quiet as possible for the patient. The bed should be made up as a rheumatic bed, the patient either lying in the blankets, or a pair of blankets should be placed between the sheets, one over and one under the body, so that the perspiration may be absorbed. A long flannel bedgown made to fasten with tapes along the front and down the arms is also useful for the same purpose, and as the sufferer is often completely helpless arrangements must be made for the removal of the bodily evacuations without movement from the bed. The pain in the joints may often be alleviated by sponging them with warm water and soap, or warm water slightly alkalinized by carbonate of soda, and after they have been dried with a soft towel, packing them in a quantity of cotton wool secured by a moderately firm roller or bandage of flannel. In this way the elbow, wrist, ankle, or knee may be kept at rest, protected from cold and pressure and provided with gentle but uniform support. Where the pain is too severe to be alleviated by these simple measures anodynes, such as opium or belladonna, may be applied in the form of lotions or ointments, or blisters may be placed on or near the affected joint during the height of the inflammatory stage. During the acute stages of the disease the diet must consist chiefly if not entirely of liquids, milk mixed with an equal quantity of soda or lime water being one of the best forms of administering nourishment. Besides milk, broth, beef-tea, arrow-root, and other easily digestible substances may be given, and the distressing thirst may be allayed by the use of soda water, lemon juice and water, toast-and-water, or plain iced water. By some writers lemon juice is recommended as a valuable medicine for the disease itself, and good results are said to have followed its administration in doses of about 8 ounces daily. When appetite returns fish, chicken, milk-puddings, &c., may be taken, but meat must be carefully avoided until every rheumatic symptom has disappeared. After convalescence the patient must be extremely careful for a long period in order to avoid a relapse, and he must ever afterwards take every reasonable precaution against taking a chill or catching cold. Persons who have suffered from rheumatic fever should keep their feet well shod and should wear flannel underclothing, varying in thickness, according to the season of the year.

Rheumatic Arthritis, or as it is more commonly called *Rheumatic Gout*, occurs both as an acute and a chronic disease, but the latter form is by far the most common, and is the only form that needs mention here. In a considerable proportion of cases rheumatic arthritis follows ordinary acute rheumatism either immediately or after the lapse of an indefinite period, but many cases occur where no previous attack of rheumatic fever can be traced. It is undoubtedly hereditary, and though its nature is quite obscure observation proves that depressing influences of all kinds are unquestionably predisposing factors. The exciting cause is generally chill or injury to a joint, and the first symptoms to be observed are pain, stiffness, and

swelling of one or more of the joints. The pain, which is increased by movement, is generally distressing, a creaking noise may be observed when the affected limb is moved, and the mobility of the limbs is impaired at first on account of the pain, and afterwards in consequence of anatomical changes. The latter are of a very serious character, and include many varieties of deformity, though these changes may be brought about with comparatively little disturbance of the general health. In confirmed cases the fingers show a great enlargement of the knuckles, and they are subject to a peculiar oblique dislocation towards the ulnar side. The elbow joint is swollen and in many cases cannot be straightened, while the wrists may be rigid and scarcely capable of motion in any direction. The knee is commonly much enlarged and rounded, and often it can only be bent with difficulty. In extreme cases every joint of the body becomes affected, and the patient is rendered a helpless cripple, unable to walk or even to sit.

The treatment of this disease must be directed first towards the arrest of the morbid process, and second towards the alleviation of the distressing symptoms. Much benefit may be obtained from the use of the mineral baths of England or the Continent, and sometimes a voyage to the tropics or sub-tropics proves of great service. The medicines most in favour are cod-liver oil, iron, iodide of potassium, and arsenic. It is unnecessary to say anything as to their administration, as with the exception of the first they can only be taken under proper medical supervision. The diet should be plain and wholesome, and stimulants, if taken, must be used only with strict moderation. Local treatment consists in the free application of counter-irritants to the affected joints, iodine paint being a very convenient material for this purpose. Another method consists in wrapping the joints in a piece of cambric or flannel, which is then sponged over with water as hot as can be borne, after which they are rubbed with a stimulating liniment or bland oil. Prolonged and steady persistence in this method is often attended with the best results in restoring or preserving the mobility of the limbs. Hydropathic treatment, including the use of the Turkish bath, hot sulphur baths, and the cold or tepid douche, with plenty of friction over the affected parts, is often of the greatest value in dealing with this disease.

Chronic Rheumatism is a very common complaint, and one from which comparatively few elderly people in Great Britain are wholly exempt. It occurs sometimes as a sequel of rheumatic fever, but more commonly it comes on quite independently of any previous acute attack. The symptoms, which are invariably aggravated by exposure to cold and wet, are pain and stiffness in the knees, ankles, hips, and shoulders, the pain being of an aching, wearying character. In some cases it is relieved by warmth, while in others it is aggravated by it, the pain always being worse when the patient gets warm in bed. While it is not uncommon in young adults it most frequently attacks persons of middle or advanced life, and it is especially prevalent among the labouring poor and those who are exposed by their occupations to cold and wet. Though rarely dangerous, chronic rheumatism is an exceedingly obstinate complaint, and while it may be alleviated and removed for a time, patients rarely lose the tendency to recurrence of pain throughout the whole of their life.

Treatment of chronic rheumatism consists in attention to the digestive organs, the administration of strengthening and tonic medicines, such as cod-liver oil and iron, and in securing rest and protection from the weather. Iodide of potassium is a useful remedy in those cases where the pain is worse at night, and guaiacum is a valuable medicine for those cases which are relieved by warmth. The best palliative treatment is found in friction with stimulating liniments, warm fomentations, and the use of counter-irritants, such as iodine paint or blisters. The hydro-

pathists have several useful methods of treating chronic rheumatism, chief among which comes the Turkish bath, with its attendant shampooing.

Muscular Rheumatism is a disorder connected with the muscular structures, is generally associated with the rheumatic diathesis, and is attended by local pain and spasm, not confined to any particular region of the body, but which may occur in almost any locality. The exciting causes of this complaint are usually exposure to cold, especially the exposure of a muscular joint to a draught after it has become warm through exertion or the over-use and strain of the muscles affected. There are several forms of this disease which are recognized by special names, the most important being muscular torticollis (or stiff neck) and lumbago. The first of these is usually the result of the exposure of the part to a current of cold air, and it most frequently affects one side, compelling the patient to keep his head fixed, or to lean it on one side so as to relieve the muscles. It is best treated by the application of hot fomentations, or the use of counter-irritants or anodynes. An excellent application may be made by crushing a good handful of chillies, steeping them for a couple of days in water, and then soaking a piece of lint in the liquor and applying it to the part affected. Mustard poultices and plasters of pepper may also be found useful in some cases. For a description of LUMBAGO and its treatment see under that heading.

RHIN, BAS, and RHIN, HAUT, prior to the war of 1870-71, were two eastern departments of France, but were wholly transferred (together with portions of other departments) to Germany in January, 1871. They now form part of the German Reichsland of Elsass-Lothringen, which comprises the whole of Alsace and part of Lorraine. See ALSACE-LOTHAINE.

RHINANTHUS. See RATTLE.

RHINE (Ger. *Rhein*; Lat. *Rhenus*). This is, in respect of length, the fourth of European rivers, being inferior only to the Volga, Danube, and Dnieper; but as a channel of commerce it is certainly the most important of continental Europe. It rises in the canton of the Swiss Grisons, and in several parts of its course separates that country from Germany; afterwards it flows a long distance through Germany (until 1871 it divided Germany from France), and finally drains Holland, where it reaches the sea by several arms. That portion of the river which lies within or along the boundary-line of Switzerland is called the Upper Rhine; from Basel to Cologne it is denominated the Middle Rhine; and the remainder of the course, to its several mouths, is designated the Lower Rhine. The various feeders of the Rhine, throughout its course, exceed 12,000 in number.

Upper Rhine.—The river originates in three branches, called the Vorder-Rhein (Upper Rhine), Mittler-Rhein (Middle Rhine), and Hinter-Rhein (Lower Rhine), in that elevated chain of the Alps which runs eastward from the mountain road of St. Gothard through Graubünden, or the country of the Grisons. The first, and most easterly, flows from Mount Crispalt (7500 feet), through a deep and gloomy ravine; the second joins it at Dissentis, 12 miles lower down, at the comparatively low level of 3500 feet; and the third, which rises in the glaciers of the Vogelberg, unites with the twofold stream at Reichenau, 50 miles distant. After their junction, near Coire, the river, which now assumes the general name of Rhine, is nearly 250 feet wide, its waters having been increased by numerous small tributaries. From Coire to Basel it is navigated in parts by rafts and small flat river boats, and it begins to run through a valley from 1 to 2 miles wide, in a nearly northern direction towards the Lake of Constance; before entering which, however, it runs through a swampy tract of small extent. The Rhine, issuing from the lake at Constance, which is 1344 feet above the sea-level, and flowing

in a western direction for a few miles, enters the Unter-See or Lower Lake. Following a westerly course, it divides Baden from Switzerland; and receives the Thur, Töss, and Aar on the left, and the Wutach and Alb on the right. Below Schaffhausen it rushes over a rock between 65 and 70 feet high. It is further interrupted by a cataract at Laufenburg and by a rapid at Höllehlacken. The total number of the affluents of the Rhine, in Switzerland alone, is said to be 2700; and the rapidity of the stream may be inferred from the fact that on a total fall of 7650 feet at the point where it leaves that country, it is above 6000 feet lower than at its source.

Middle Rhine.—At Basel, where this division of the river begins, it has entirely left the region of the Alps and Jura mountains, and at the same time changes its western into a N.N.E. and northern course. The inclination becomes considerable and the stream rapid. In addition to the swiftness of the current, the wide bed of the river contains numerous sandbanks and small islands, which are subject to sudden and frequent changes in their form and position. Navigation in this part of the Rhine is accordingly limited. As the river advances northward the rapidity becomes less and the islands fewer. It passes Strasburg, Spire, Mannheim, Worms, Oppenheim, Mainz or Mayence, Bingen, Coblenz, and Bonn. From Mainz to Cologne the course of the river is closely followed by a railway on each side. Below Mainz, and commencing at Bingen, the Rhine runs between two mountain regions in a narrow valley. This valley, which extends about 80 miles, from Bingen to Bonn, is the most beautiful part of the river, and yearly attracts numerous visitors. The scenery has been celebrated by the most eminent German writers, and extolled by travellers from every land. Perhaps no tribute of praise is better known, nor, on the whole, more accurate in detail as well as elegant in style, than Byron's famous eulogium in the third canto of "Childe Harold":—

"The wide and winding Rhine,
Whose breast of waters proudly swells
Between the banks which bear the vine,
And hills all rich with blossom'd trees."

Numerous tributaries join the Rhine in its middle course. Those which flow into it from the west are chiefly the Moselle and its confluent. Those from the east are the Neckar, Main, Lahn, and Sieg.

Lower Rhine.—From Cologne to its mouth, a distance of about 300 miles, the course of the Rhine is through a low level country. The current is extremely gentle. Near the village of Pannderden, which is within the territories of Holland, the Rhine divides into two arms, of which the southern is called the Waal, and the northern preserves the name of Rhine. Nearly two-thirds of the volume of water run into the Waal, which is more than 210 yards wide, while the Rhine is only 114 yards wide. The Waal runs westward and the Rhine N.N.W. The Rhine divides again about 12 miles lower down, above Arnheim, into the New Yssel, which runs to the north, and the Rhine, which turns off to the west. Running westward, it divides for the third time about 30 miles lower down, at Wyck. The southern arm is called the Lek, and the northern goes by the name of Kromme Rijn (Crooked Rhine): the Lek is the larger river. The Crooked Rhine runs north-west to Utrecht, where it divides for the fourth and last time. The arm which runs northward is called the Vecht, and falls into the Zuider Zee: the other, the name of which is changed into that of Oude Rijn (Old Rhine), continues westward through the marshes of Holland, where the waters are employed feeding numerous small canals, by one of which it reaches the sea. The Waal joins the MEUSE, or Maas, near Gercum. The Lek, or middle branch of the Rhine, runs from Wyck westwards for about 30 miles, and enters an arm of the Meuse that runs along the north shore of the island of Ysselmonde. Besides the

ivers above named, the Lower Rhine receives the Erft, Ruhr, and Lippe. The whole country between the arms of the Rhine is intersected by numerous canals, most of which serve for the purpose of internal navigation.

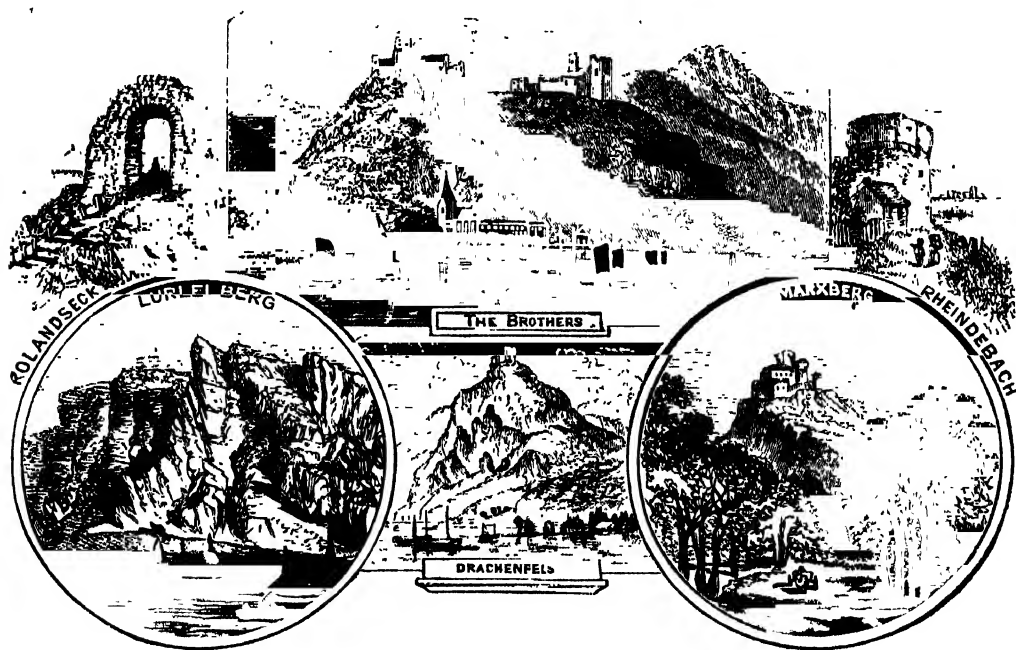
The course of the Rhine amounts to about 800 miles, of which about 570, from Basel to its mouth, are navigable. A direct line from its source to its mouth would only be a little over 400 miles long.

The delta of the Rhine (50,000 square miles) is bounded on the east by the Yssel, on the south by the Waal and Maas, and on the other sides by the North Sea and the Zuider Zee, comprehending the whole of the three Dutch provinces of North and South Holland and Utrecht, and nearly two-thirds of Guelderland. The whole of the Lower Rhine is subject to destructive inundations. The delta would occasionally be flooded if it were not protected by embankments.

The basin of the Rhine, according to a tolerably accurate calculation, covers a surface of 87,178 square miles.

Though it extends from $46^{\circ} 30'$ to 52° N. lat., nearly the whole of it enjoys the same climate, on account of the southern portion having the greater elevation.

From Basel to Mainz the Rhine is navigable for barges of 100 tons; from Mainz to Cologne, for vessels of 200 tons; and lower down, for vessels of 600 tons. The river is connected by canals with the Saône and Rhône, the Scheldt, the Meuse, and the Danube. A very important trade in colonial produce, manufactured goods, timber, coal, iron, corn, wine, and other agricultural products is carried on by the Rhine and its chief navigable feeders, the Moselle, the Main, and the Neckar. This trade has been greatly increased by the policy of Germany, which has rendered the large towns on her part of the river free ports; and the resolution of the government of the Netherlands in 1850 to abolish the Rhine duties altogether added a great stimulus to commerce. The river is also navigated by steam vessels belonging to several companies, which ply constantly on its middle course; and it is visited by tourists from all



Celebrated Sites on the Rhine.

countries on account of its picturesque scenery. The chief characteristics are wildness and rude grandeur in the defiles above Constance, and from the Unter-See westward as far as Rheinfelden; but at this point the character of the scenery changes, and the river becomes a broad and majestic stream, flowing as far as Mannheim through a rich open valley. The banks there begin to be more bold and rocky; but the scenery most generally admired is chiefly between Bingen and Bonn. Here the Rhine pursues a meandering course pent between lofty and craggy mountains, and resembles rather a succession of lakes than a river.

The *Rhenus* or Rhine (Gr. *Rhénos*) became first known to the Romans by the conquest of Julius Cæsar, who crossed it twice to punish the Germans. Ancient writers, though agreed with respect to its general course, differ respecting the number of mouths by which it falls into the

ocean. Tacitus ("Ann." ii. 6) speaks of two only, one of which, probably the modern Waal, he terms *Vahalis*, and the other *Rhenus*. Pliny and Ptolemy, however, say that there were three mouths, the most northerly of which, called Flevum, was supposed to have been formed by a channel dug by Drusus, to connect the Rhine with the Ivala, which is, most probably, identical with the Yssel, as Pomponius Mela (iii. 2) assures us that it fell into the Lake *Flevo*, the modern Zuider Zee. No doubt, however, the channels of the river in the delta must have shifted, both prior and subsequently to the accounts given by the classical writers; besides which, the inroads made by the sea on the coast of Holland render it impossible to ascertain what may have been the exact number of its mouths at any very remote period. In modern times the sovereigns and statesmen of France seem to have regarded the Rhine as constituted by nature to be the eastern boundary of the

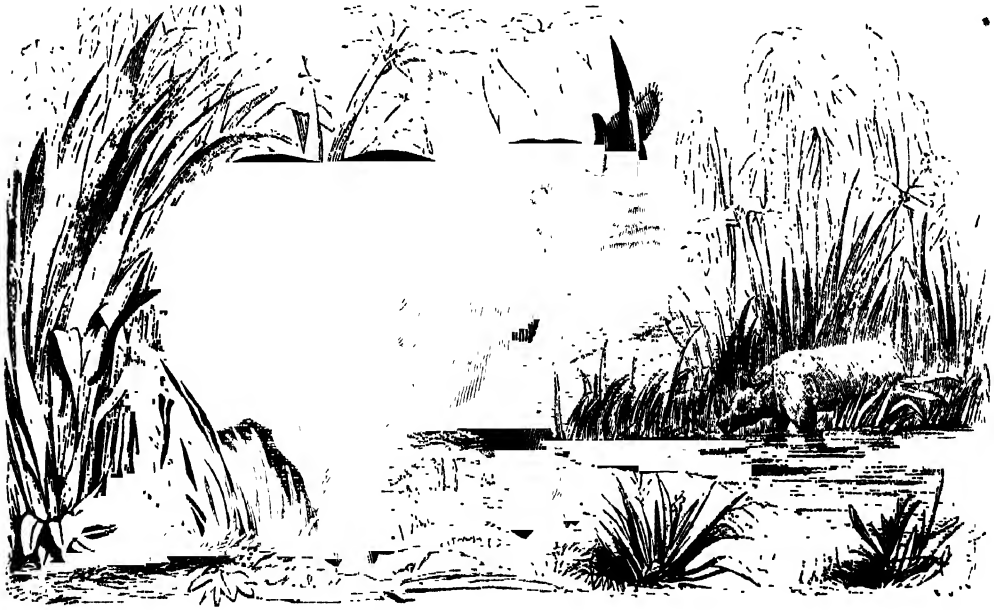
country, not only in parts of its course, but from the point where the river dribbles to the sea through the sands of Holland to its sources in the Swiss canton of the Grisons, and thence along the main crest of the Alps to the Mediterranean. The obstinate indulgence of this fanciful notion has cost France and Germany dear both in treasure and blood, while entailing incalculable miseries upon the industrial populations on both banks of the noble stream.

RHINE, PROVINCE OF. See RHENISH PRUSSIA.

RHINOCEROS is the sole recent genus of the Rhinocerotidae, a family of Ungulates belonging to the sub-order PERISSODACTYLA. At the present day there are five or six species of rhinoceros, confined to Africa south of the Sahara, and the warmer parts of Asia, but in Tertiary times this, with nearly allied genera, existed all over the world.

The animals of the present genus are all remarkable for the massiveness of their form and the clumsiness of their proportions; they are, however, more prompt and rapid than might be at first supposed, and when attacked they

rush on their foes with headlong impetuosity. The body is of great bulk, and protuberant at the sides; the neck is short and deep; the shoulders are heavy, the limbs thick; the feet are divided into three toes, incased in hoofs; the skin is thick and coarse, with a knotty or tubercular surface, destitute, or nearly so, of hairs, and often thrown into large folds, especially on the neck, shoulders, haunches, and thighs. The eyes are small, and placed near the nose and high towards the upper surface of the skull. The ears are small, oval and erect. The head is large and ponderous; it is elevated between the ears, whence it sweeps with a concave line to the nasal bones, which rise in the form of an arch to support the horn. The upper lip is soft, flexible, sensitive, capable of being protruded, and used to a certain degree as an organ of prehension. But that which gives most character to the head of the rhinoceros is the horn—single in some species, double in others. This organ is of an elongated recurvent conical figure, arising from a broad limpet-shaped base, seated on the nasal bones, which are of immense thickness and solidity.



Burchell's Rhinoceros (*Rhinoceros simus*).

In the two-horned species the posterior horn rests on the frontal bones. The horn of the rhinoceros is a solid mass, structurally composed of agglutinated fibres, which are analogous to hair, but differ in growing from a free papilla, instead of from a follicle, of the dermis or true skin. The full dentition is expressed by the formula:—

$$I. \frac{2-2}{2-2}; c. \frac{0-0}{0-0}; pm. \frac{1-4}{4-4}; m. \frac{3-3}{3-3} = 36.$$

The incisors are variable in number, being often quite rudimentary and deciduous. The upper molars have sub-quadrato crowns with two transverse ridges; the lower molars are narrower and longer, with the crowns formed by two crescents.

The Indian Rhinoceros (*Rhinoceros unicornis* or *indicus*) has a single large curved horn on the nose, and four incisor teeth in each jaw, the median pair being the larger in the upper and the smaller in the lower jaw. Its average height is about 4 feet. The skin is naked, very thick, of a dull deep purplish-gray, marked with sub-elevated,

rounded, and other inequalities, and remarkable for the deep folds which it forms, especially behind and across the shoulders, and before and across the thighs. There are a few stout, stiff, horny, and smooth hairs on the tail and on the ears.

This species inhabits the East Indies, especially beyond the Ganges. It is recorded as having been found in Bengal, Siam, and Cochin-China. Shady forests, the neighbourhood of rivers, and marshy places are favourite localities. Their ordinary food consists of herbage and the branches of trees. The flesh is said to be not unpalatable. It leads a tranquil, indolent life, wallowing on the marshy banks of lakes and rivers, and occasionally disporting itself in their waters. Its movements are tardy, and it carries its head depressed, cutting up the ground with its horn, and pressing its way through the jungle by sheer strength and bulk. See Plate.

The Javan Rhinoceros (*Rhinoceros sondaicus*) has also a single nasal horn, which is rudimentary or absent in the female. It is distinguished from the preceding species by its

smaller size and proportionately longer and more slender head and limbs. The skin is not thrown so strongly into folds, and is covered with numerous polygonal scutes, whose centres are depressed and give origin to short bristly hairs. The margins of the ears and the under side of the tail are also bristly. This species inhabits the Bengal Sunderbunds, Burma, the Malay Peninsula, Java, and Sumatra. It is said to be gregarious in many parts, and to be milder of temper than the Indian species.

The Sumatran Rhinoceros (*Rhinoceros sumatrensis*), the smallest living species, has only one incisor above and below, the latter being sometimes lost in old age. There is a well-developed nasal and a small conical frontal horn, separated by an interval. The skin is rough and slightly provided with hairs; but the folds are not strongly marked. Its range is nearly co extensive with the Javan species, except that it is not found in Bengal; it is found in Borneo, of which island the latter species may also be an inhabitant.

The Hairy-eared Rhinoceros (*Rhinoceros lasiotis*) is nearly allied to the Sumatran species, of which it may be only a variety. It is distinguished by the ears being fringed with long hairs, by the body being smoother and covered with long fine reddish hair, and by the shorter tail. It is a native of Chittagong.

The African Rhinoceros (*Rhinoceros bicornis* or *africanus*) has the incisor teeth rudimentary or wanting, two well-developed horns in close contact, and the skin without definite folds. The African Rhinoceros is about 11 feet long and 5 feet high, with a highly prehensile upper lip. The colour of the skin is a pale yellowish-brown. The tail is about 2 feet long, and bristly at the tip. This species is found throughout Africa from Abyssinia to Cape Colony, haunting chiefly the sides of wooded hills, and feeding on the leaves and branches of bushes and small trees, especially thorn trees. A variety called the Keitloa or Sloan's Rhinoceros, differs chiefly in having the posterior horn as long or longer than the anterior, both being about 20 or 22 inches long; by some it is considered a distinct species. It is chiefly found in South Africa. The African Rhinoceros is very swift and ferocious.

Burchell's or the White Rhinoceros (*Rhinoceros simus*) is the largest species of Rhinoceros, measuring over 12 feet, and standing about 5 feet 6 inches high at the shoulder. The skin is smooth, without folds, and of a pale grayish-brown colour; at the tips of the ears and the tip of the tail are stiff black hairs. There are two large rounded horns, the anterior measuring from 2 feet 6 inches to 4 feet long. It has a square truncated upper lip. Burchell's Rhinoceros is only found south of the Zambesi, chiefly in open districts; it feeds entirely on grass. It is milder in disposition and less swift than the common African species. The flesh is said to be excellent. A local variety with the front horn pointing forwards and sometimes even downwards, is by some considered a distinct species under the name Osowell's Rhinoceros (*Rhinoceros oswellii*).

Fossil Species.—These animals existed in the Tertiary times not only in their present haunts, but in Europe, Northern Asia, and America. *Aceratherium*, from the Miocene of Europe and America, differed from the existing rhinoceros in having four toes on the anterior limbs, and in having no horn. In America they seem to have become extinct before the close of the Pliocene age. In Europe and Asia species referable to the genus Rhinoceros were abundant through the Pliocene and Pleistocene ages. In the bone caves of England, such as Kent's Hole, Cresswell, Brixham, &c., remains of the Woolly or Tichorhine Rhinoceros (*Rhinoceros antiquitatis*) have been found. In Siberia it has been found embedded in ice with the skin still clothing the body. It was contemporaneous both with the mammoth and man himself. Remains of two other extinct species have been found in Britain.

RHIPSALIS is a genus of plants belonging to the order Cactæe [see CACTUS] and tribe Opuntieæ. The species are usually epiphytes, and consist of leafless plants with jointed branches, and white flowers growing out of the sides of the branches, followed by white pellucid berries. They are natives of tropical America. The perianth of the flowers have a very short tube, and twelve to eighteen spreading segments, of which the outer are scale-like and greenish, and the inner large and whitish; the stamens are numerous. Several species are cultivated in our hothouses.

RHIZOCARPEÆ is a group of flowerless plants (CRYPTOGAMIA) containing the genera Salvinia, Azolla, Marsilea, and Pilularia. The spores are either large (macrospores) or small (microspores). The microspores produce antherozoids, while the macrospores, which are several hundred times as large as the microspores, produce a small prothallium and one or several archegonia. The sporangia, which contain either macro- or micro-spores, are found in hollow capsules, called sporocarps, and in Salvinia the sporocarps contain only one kind of spore.

RHIZOME, in botany, is the name given to a creeping underground stem. The rhizome of the potato plant produces tuberous growths, the potatoes. Many grasses and sedges have rhizomes, and some kinds are planted along sandy sea-shores to bind the loose sand together and prevent its drifting.

RHIZOPHORÆ (the MANGROVE family) is an order of plants belonging to the POLYPETALÆ. The plants are remarkable for their seeds germinating even while attached to the branches, and also for the numerous adventitious rootlike projections which serve as supports for the stem. The common mangrove and also others of the genus are found all along the shores of the tropics, both in the New and Old World, rooting in the mud, and forming dense forests even at the verge of the ocean, and below high-water mark; hence, on the retiring of the tide, the stems may often be seen covered with oysters and other shell-fish.

Rhizophora Mangle (the common or black mangrove) is found abundantly on the shores of the ocean and within the delta of the Ganges, where it grows to a considerable size.

Rhizophora Candel (or red mangrove). The wood of this species is heavy, of a deep red, and takes a fine polish. The bark is used in dyeing red, is astringent, and used in the West Indies for the cure of fevers.

Rhizophora gymnorhiza grows to a considerable size where the spring-tides rise over it, as in the delta of the Ganges. The wood is yellow, hard, and durable; has a sulphurous smell, and burns with a vivid light; is chiefly used by the natives for fire-wood, and for making posts for constructing their houses. The pith of the wood, boiled in palm wine or with fish, is used for food.

The following are the chief characteristics of the order:—The lobes of the calyx (three to fourteen) are valvate; the petals are of equal number to the calyx-lobes; the stamens are two, three, or four times as many; the ovary is syncarpous, two to six-celled, generally inferior, rarely superior; style simple; ovules two in each cell, pendulous. The species are trees or shrubs, the leaves generally opposite and stipulate.

RHIZOPODA (root-footed) is the name given to a leading group of animals belonging to the subkingdom PROTOZOA. The Rhizopoda are distinguished by their protoplasmic cell-bodies being generally without any well-defined shape, the protoplasm of the periphery being more or less homogeneous with that within; even where a membranous or silicious shell is present the protoplasm has usually the power of flowing out through one or more apertures, and covering the outside as well as filling the interior of the shell. In consequence there is no definite cell-mouth, as in the INFUSORIA. Locomotion is usually by means of

pseudopodia, lobes of the cell-body which can be protruded at any part of the cell and retracted. In the higher forms these pseudopodia are more or less permanent, and often form a network of slender interlacing threads. The Rhizopoda may be divided into six orders. The order Monera contains the simplest of all animals, the body consisting of naked homogeneous protoplasm, in which no nucleus has yet been detected; their life-history resembles that of the Myxomycetes, the lowest known plants; examples are *Protomyxa*, a marine form found by Haeckel on shells of *Spirula*, and *Vampyrella*, which is parasitic on the cells of the alga *Spirogyra*. The order Amoeboidea contains the well known *Amoeba*, which has blunt, lobose pseudopodia; *Pelomyxa*, which grows to a comparatively large size and has its protoplasm greatly vacuolated; and *Arcella*, in the protoplasm of which there is a peculiar gas-vacuole with probably a hydrostatic function. The order Labyrinthulida contains a few remarkable forms (*Labyrinthula*, *Chlamydomyxa*), in which the protoplasm forms a network of very fine threads, among which are numerous minute oat-shaped bodies, each of which is probably to be regarded as a distinct cell, the whole forming a colony. The order Radiolaria contains a large number of shell-bearing oceanic rhizopods, the shells of which are present in considerable quantities in the "ooze" which covers the bed of the Atlantic Ocean, and in the fossil state have taken a large share in the formation of tertiary rocks. The body of the Radiolarian is more or less spherical, inclosed in a finely perforated membranous shell, called the "central capsule," which appears to correspond to the chambered shell of the Foraminifera. Outside this central capsule there is usually a silicious skeleton, built up of rod-like spicules, either loose or forming a basket-like case. The protoplasm within the central capsule is continuous with that outside; embedded in the former is the large specialized nucleus, several of which are often present. There is no contractile vacuole. The pseudopodia radiate from the outer protoplasm, and are rod-like and seldom ramify. Scattered in the outer protoplasm are generally observed numbers of yellow nucleated bodies, which are considered to be parasitic alga; they have a cellulose cell-wall, and contain chlorophyll, the presence of which is marked by a yellow colouring matter; they multiply by fission, and live after separation from the body of the Radiolarian. Numerous species have been established on differences in the character of the skeleton. *Thalassiosella*, a large form common in the Mediterranean, has no skeleton. Some form colonies, as *Sphaerocoon*. The last two orders, HELIOZOA and FORAMINIFERA, are separately noticed.

RHODE ISLAND, one of the United States of North America, the smallest in the Union, is bounded N. and E. by Massachusetts, W. by Connecticut, and S. by the Atlantic Ocean. The largest part of the state lies to the west and north-west of Narraganset Bay, and comprehends about 900 square miles; a small portion lies to the east of it; and the rest is composed of Rhode Island, Connecticut, Prudence, Patience, Hope, Hog, Dyer's, and Block Islands, all of which are in Narraganset Bay, except the last, which is in the Atlantic. The total area of the state is 1306 square miles. The population in 1880 was 276,531.

Rhode Island, which gives its name to the state, is the largest of the islands which belong to it. Its length is about 15 miles north to south, with an average breadth of $3\frac{1}{2}$ miles. It is the most fertile part of the state; the soil is suitable either for tilling or grazing, and is well cultivated; and the climate is very temperate and wholesome.

Narraganset Bay, which intersects a large portion of the state, is about 28 miles long from Point Judith, on the south, to Bullock's Point, 5 miles below Providence, on the north. The average breadth of the bay is about 10 miles. It forms a safe road during the north-west storms, is navigable in all seasons, and contains several excellent har-

bours—one of which is a naval station of the United States.

The surface of the continental part of the state of Rhode Island is generally very level, but hilly and rocky in some parts, chiefly to the north-west. The principal rivers are the Seekonk, the Pawtucket, the Pawtuxet, and the Paroquet, all of which have a short course. The soil is generally thin, and for the most part better fitted for pasturage than for the plough. The corn raised is scarcely sufficient for the home consumption, though wheat, oats, barley, and rye, as well as many kinds of fruit, are cultivated. The rivers and bay supply plenty of fish. There are mines which yield a considerable quantity of iron ore, and small quantities of copper ore are obtained. Limestone is abundant, and there are extensive beds of anthracite coal.

The exports are principally cattle, horses, poultry, fish, beef, pork, cheese, butter, lumber, and flax seed, cotton, linen, and iron manufactures. The imports consist for the most part of the produce of the West Indies and the manufactures of Europe. The state occupies a leading place in industrial activity; important manufactures of cotton, woollen, iron, leather and paper being carried on. Several railways and steamboat lines connect the chief towns with Massachusetts, Connecticut, and New York.

Newport and Providence are the capitals. The *Vinland* discovered by the Norsemen in the tenth century is supposed to have been Rhode Island. The earliest discoverers called it *Claudivia*, but a later expedition coming upon it when the woods were in autumn colours called it Rood Eylandt or Red Island. It was bought from the Indians, who called it *Aquidneck*, the isle of peace, and the state was first established at Providence, in 1636, by Roger Williams, who fled from Massachusetts in consequence of the persecution to which he and his Baptist congregation were subjected on account of their religious opinions. A charter was granted by Charles II. in 1663, which formed the basis of the constitution till 1842, when a new constitution was formed, and is now in operation. The legislature consists of thirty-six senators and a house of representatives, both elected for one year. The governor, who has no veto power, lieutenant-governor, secretary, treasurer, and attorney-general are also chosen annually by the people on the first Wednesday in April. Every male citizen of the United States of the age of twenty-one years, who has resided in the state two years, and in the town where he offers to vote for six months, and who is duly registered, is an elector for all civil officers, and is further qualified as follows:—He must have paid a tax of one dollar, or he must have done duty in a military company in this state, as an equipped member, for one day during the year.

Rhode Island was one of the original thirteen united provinces, the people of which declared themselves independent in 1776, and were acknowledged as such by Great Britain in 1783.

RHODES, an island in the Mediterranean, off the south-west coast of Asia Minor, belonging to Turkey, extends from $35^{\circ} 53'$ to $36^{\circ} 28'$ N. lat.; and from $27^{\circ} 40'$ to $28^{\circ} 12'$ E. lon. Its greatest length from north to south is about 16 miles, and the greatest breadth about 22 miles. Its area is 424 square miles. The air is so mild and healthy, and the soil so fertile, that it has obtained the name of "the Pearl of the Levant." It is traversed by a mountain chain, covered with forests, which supply good timber for shipbuilding. Corn, grapes, figs, oranges, lemons, &c., are cultivated; but notwithstanding its advantages the produce of corn is scarcely sufficient for the consumption of the inhabitants, and the island generally is far from being prosperous. The chief articles exported are sponges, valonia, olive oil, tobacco, fruits, &c. Cotton grown in the island is pronounced in Manchester to be the whitest known, but the poverty of the inhabitants restricts

its cultivation. Large groves of olives have been planted, which will in course of time prove very remunerative if protected from the herds of sheep and goats which roam unrestrained, and are the worst enemies to the plantations. The chief articles imported into the island are cotton goods, French fancy articles, and other European manufactures. Wine is still produced, and a large quantity of grapes are dried. The total population of the island is about 27,000—composed of 18,000 Greeks, 6000 Turks, and 3000 Jews. The peasants live almost exclusively on the produce of the soil; those near the chief town alone use some articles of European manufacture for their garments, and are provided, although very scantily, with foreign articles of luxury, such as coffee, sugar, &c.; in the more distant villages they all indiscriminately use cotton and woollen cloth spun by the women. Rhodes contains few remains of its ancient towns.

RHODES, the capital of the island, is a fortified city at its north-east extremity, and 13 miles south-east of the nearest promontory of Asia Minor. At the mouth of the harbour stood a tower with a revolving light, 118 feet high; but this light-tower, as well as the former palace of the grand master, was ruined by an earthquake in 1863, which also destroyed about 2000 houses and killed many of the inhabitants. Rhodes is inclosed by walls, built by the Knights of St. John, whose hospital may still be seen. The city has thirty-three mosques, a Jews' quarter, and the ruins of a synagogue. Outside the walls, on the north, are the pasha's palace, the dockyard, and a Roman Catholic quarter. To the south are the Greek suburbs with about ten churches. The town contains three Mohammedan colleges, a Turkish library, Turkish and Greek schools, &c.; and is the residence of British, French, and Greek consuls. Some manufactures of red leather and shoes for exportation are carried on; but they are neither important nor thriving. On the north-east side there are two harbours, but they are both in a very bad state, and do not afford shelter from the north and north-east winds. Steam packets are obliged to remain in the roadstead, and are often prevented from communicating with the island at all in stormy weather. Rhodes is in telegraphic communication with Candia, Smyrna, Syria, and Egypt.

There are no remains of the ancient city of Rhodes earlier than the time of the knights, but all their works are interesting specimens of the military architecture of the middle ages. The buildings of the town exhibit a curious mixture of European and Saracenic styles.

History.—Rhodes (Gr. *Rhodos*, as if connected with *rhodon*, a rose) was said to have been named after a daughter of the sea god Posëidon, a consort of the sun-god Hêlios, to whom she bore seven sons in this island. This legend evidently refers to the seven tribes which anciently divided Rhodes. The island early became quite Hellenized, and this is referred in legend to a colonization by Tlepolemos, the son of Hêraklêos. Later the cities of Kos, Knidos (Cnidus), and Halikarnassos parcelled out Rhodes between them, and under this peculiar kind of monarchical confederacy the island developed a great maritime power, sending out colonies to Italy, Sicily, and the far off Balearic Islands and Iberia itself (Spain). About B.C. 660 an oligarchical republic took the place of the confederacy of states. In the conflict for supremacy between Athens and Sparta (Peloponnesian War) Rhodes changed protectors many times, and after that it suffered from conflicts between the democrats and oligarchs for a long time. In B.C. 355, at the end of the Social War, however, its independence was acknowledged. The city of Rhodes and the capital of the island had been founded about half a century before that, by the three chief towns joining together for that purpose. After the break up of the Macedonian kingdom of Alexander, Rhodes made an alliance with Ptolemy, one of Alexander's generals who had become king of Egypt, and although the choice was

a prudent one, yet in the perpetual conflicts between the new general-kings Rhodes necessarily suffered. By the liberal assistance of Ptolemy she was able to overcome all difficulties, and even successfully withstood a siege by the famous "destroyer of towns," Demêtrios (Poliorketês), in such a manner as to make the defence famous in antiquity. In fact Demetrios, foiled though he was, knew how to recognize heroism and skill in an antagonist, and although he failed to enter the city his skill as a besieger was vindicated by the breach he had made in the walls. He therefore presented the city, on his departure, with all his engines of war used in the siege, a considerable mass of material (B.C. 304). These were sold, and with the proceeds of the sale the Colossus of Rhodes was constructed. Protected by the great Ptolemy and his equally great successors, Rhodes now developed a maritime power of considerable magnitude, trading far and wide, and obtaining a practical supremacy over the Eastern seas. Following the astute policy which had attracted them to Ptolemy, the Rhodians next allied themselves with the rapidly growing power of Rome, and when Syria was cut up into provinces they were rewarded for the substantial assistance they had afforded to the Roman expedition against Antiochos, by the possession of a large part of Caria on the mainland, already partly colonized by themselves, and now called the Rhodian Peraia. Like most prosperous commercial communities, Rhodes soon developed a fine taste for art, and Strabo says that it surpassed all the cities of his time in beauty and ornament. The paintings of Protogenes founded a school, and the companion school of sculpture was one of the most famous in the later Greek period of art. Not less than 3000 fine statues adorned the city. The school of oratory founded by Æschines (the opponent of Demosthenes) was proverbial for its highly-finished florid style, and "Rhodian eloquence" is a phrase frequently met with in the ancients. The maritime command of the sea caused a code of laws to be gradually compiled, which were improved into such excellence that most trading nations adopted them, and the Romans imported them bodily into their own code.

The friendship with Rome was broken by Rhodes adopting the cause of Perseus of Macedonia, which brought down severe punishment upon the island at the hands of the tyrant of the world; but Rhodes purchased its peace later on by naval aid given to Rome in the Mithradatic War. In the great civil wars Rhodes, with her customary insight, took part with Cæsar; this, however, exposed her to the vengeance of Cassius after Cæsar's death. In 42 B.C. Cassius plundered the island like a treasury, stripping the temples to the bare walls. Mark Antony later on did what he could to repair this savage treatment. The independence of Rhodes ceased under the Emperor Claudius, and it became a shadow of its former greatness; till at last, in 165 A.D., in the reign of the Emperor Antoninus Pius, a tremendous earthquake laid the once-famous city in ruins.

In 616 A.D. the Persian king Khosrû (Chosroes) obtained possession of Rhodes, and later on the celebrated Moawiyah, the enemy of Ali, conquered it for the Saracens in the caliphate of Othman. Still later it was retaken by the empire (the Byzantine Empire), and was in fact the last possession in Asia which it retained. In 1308 the Emperor Emmanuel granted it as a fief to the Knights Hospitallers of St. John, who skillfully fortified it so that it became almost impregnable, defended as it was by picked knights trained under the finest discipline of the age.

Almost immediately the Knights of St. John had become lords of the island they had to stand a fierce siege by the Turkish Sultan Othman, but their superior organization and carefully planned defences prevailed. Afterwards they established themselves at Smyrna, which became in their hands a strong outwork of their possessions. They could not

hold it against Timur, however; it fell to him in 1401. The conqueror of Constantinople, Mohammed II., brought his train of siege artillery against Rhodes in 1480, when the strength of the knights was no longer what it was, but they were still able to beat him off. In 1522, however, the Ottomans came again in overwhelming odds, while the knights were much enfeebled in defences and in men. They begged for assistance from the European powers in vain, and after a really desperate resistance of four months, were forced to capitulate. On 1st January, 1523, the last shipload quitted the island they had held with some glory for over two centuries. Malta received them, and they flourished there with renewed vigour till Bonaparte drove them out in 1798. Since 1523 the island of Rhodes has been in possession of the Turks, but its picturesqueness is due to the remains of the buildings of the famous knightly order.

RHODES, COLOS'SUS OF. When Demetrius, the "destroyer of cities," gave over the siege of Rhodes after prosecuting it for more than a year (B.C. 305 to 304) he made a friendly treaty with the city, and even presented it with all his material of war. The proceeds of the sale of this realized a large sum, and with additions on the part of the city and its allies the sum of 300 talents was raised. The value of the Rhodian talent is not quite definite, but this certainly cannot have been less than £75,000. The sculptor Charès of Lindos, the favourite pupil of Lysippos, was engaged to produce a bronze statue of the sun-god which should be the wonder of the world. After years of incessant labour the enormous statue was completed. It stood 105 feet high, and was placed at the entrance of the harbour, where it served as a beacon to distant ships. It took twelve years to erect, and was finished in B.C. 280. The statement frequently met with among the ancients that it stood with one leg upon each pier of the harbour, and that ships entered the harbour beneath it, is now shown to be an entire fiction. Probably the legs were not outspread at all. An earthquake overthrew the Colossus in B.C. 221, fifty-six years after its completion; Pliny has left an account of the wonder excited in him by the sight of the fragments, still left lying there in the first century of our era. They were, in fact, not removed for 880 years, till A.D. 656, when the Saracen general Moawiyah, who had conquered Rhodes, sold them to a Jew of Emesa for old metal. Upon removal the fragments made up 900 camel-loads.

RHODIGONIC ACID is obtained from a red substance found in the residue in the retort resulting from the preparation of metallic potassium. This substance is rhodigonalate of potassium ($C_6H_2K_2O_6$). It is formed as a secondary product in the action of carbon on potassium carbonate, and thus is troublesome to the manufacturer, as it largely decreases the yield of potassium. It is insoluble in alcohol, but soluble in hot water, forming a yellowish-red solution. The acid ($C_6H_2O_6$) crystallizes in rhombic prisms; it is colourless and soluble in water, forming a colourless solution, which becomes red on heating and colourless again on cooling.

RHODIUM, a metal belonging to the platinum group. Native platinum sometimes contains 3 per cent. of this metal. It was discovered by Wollaston in 1804. The atomic weight is 104, the symbol Rh. It is a very hard, brittle metal, of a steel gray colour, and less ductile or malleable than platinum. The specific gravity is 12. It can be fused in the oxyhydrogen furnace, and is rather more fusible than iridium, but less so than platinum. It is not affected by the air except at a red heat, when it becomes oxidized. It is insoluble in all acids, even in nitrohydrochloric acid, unless alloyed with other metals; but it combines with chlorine at a red heat. Rhodium forms alloys with many metals. An alloy with gold is found native in Mexico; the alloys with zinc and tin are

crystalline. With steel it forms a hard bright alloy, which is suitable for specular mirrors. There are four oxides of rhodium: the protoxide (RhO), the sesquioxide or rhodic oxide (Rh_2O_3), the dioxide (RhO_2), and the trioxide (Rh_3O_4). The protoxide is a dark gray powder which is not acted on by acids. The sesquioxide is also gray, but it forms several hydrates, some of which are soluble in acids, forming salts of a characteristic rose colour, from which the name of the metal is derived. The dioxide is dark brown, and is insoluble in acids. It forms a green hydrate. The trioxide is a blue powder, easily reduced to the hydrated green dioxide.

The best known salt of rhodium is the trichloride or rhodic chloride ($RhCl_3$), a red insoluble compound. It forms crystalline double salts with the alkalis. These salts are known as chlororhodiates. The salts of rhodium are distinguished by the rose colour, and by the need of alcohol, which in the presence of excess of potash precipitates rhodium in the metallic state. It is also precipitated from solution by zinc. It is usually separated from its alloys by fusing with potassium bisulphate, which converts it into the double sulphate of rhodium and potassium, soluble in water.

RHODOCHROSITE, so called from its roseate colour, is a carbonate of manganese, commonly occurring in veins in association with ores of silver, lead, and copper, and other compounds of manganese. It is translucent, has a vitreous lustre, and is often referred to under the name of *manganese spar*. It is used in colouring glass.

RHODODENDRON (Gr., rose-tree), a genus of evergreen shrubs, of the order ERICACEÆ, very common in gardens, is one which differs from AZALEA, principally in the stamens being ten instead of five, in the corolla being campanulate, not tubular, and in the foliage being hard and evergreen. The species are nearly related to each other, and occur both in the New and Old Worlds. Of the numerous varieties to be seen everywhere in flower in this country, in the months of May and June, the greater part belong to *Rhododendron ponticum*—a species found wild on the coasts of the Black Sea, from the range of Caucasus through Armenia and Georgia to the western frontier of Persia; to *Rhododendron Caturbiense*, an American species; or to hybrids between these. *Rhododendron ponticum* was at one time supposed to be the plant which rendered the honey of Asia Minor poisonous, but it has been ascertained that the effect is really produced by *Aranea pontica*. In the warmer parts of India there occurs the Tree Rhododendron (*Rhododendron Falconeri*, *arund*, and others) with crimson or white as

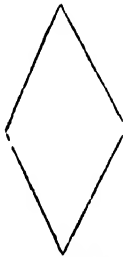
means of crossing the crimson tree rhododendron with some of the hardy species, a race of hybrids has arisen which are much cultivated. They are, perhaps, more beautiful than any of their parents. The most curious of these hybrids is a yellow one obtained by crossing a rhododendron with a Chinese azalea. The Alpine rhododendrons, *Rhododendron hirsutum* and *ferrugineum*, with small campanulate crimson flowers, are handsome dwarf shrubs in elevated situations, but they dislike the low grounds near London. They yield an oil called *Œle de Marmotta*, which the Alpine peasants use in gout and affections of the joints. The leaves of *Rhododendron chrysanthum*, a species with yellow flowers from Siberia, have a great reputation as a remedy for chronic rheumatism; its effects are those of a powerful narcotic. Almost every variety has been acclimatized in the United Kingdom, and will be found from Cobham Woods, in Kent, the seat of the Earl of Darley, to Roseneath, in Dunbartonshire, a seat of the

Duke of Argyle. They are common, moreover, in the humblest gardens, and require but little attention.

RHODOPE (Gr. *Rhodopé*), a lofty range of mountains in Thrace, sacred to the god Dionusos, and forming the eastern frontier of the ancient Macedonia. Its modern name is *Despoto Dagh*.

RHODOPIS ("the rosy-checked"), whose real name was Doricha, a very beautiful Thracian *hetaira*, famous as being once a fellow-slave in Samos with *Æsop* the fabulist. After many adventures she was ransomed from slavery by Charaxos, the brother of the poetess Sappho. Her brother's quixotic conduct enraged Sappho, and she assailed Rhodôpis in violent verses. So famous was she, and at one time so wealthy through the gifts of her admirers, that the fable went that she had built the third pyramid at Gizeh. This, of course, we know to be absurdly incorrect. Her name passed into a proverb, "As beautiful as Rhodôpis."

RHOMB or **RHOM'BUS**, **RHOM'BOID**. A *rhombus* or *rhomb*, which is called in common parlance a *lozenge*, is a four-sided figure and a parallelogram; all its sides are equal, and so far it resembles the square, but none of its



Rhombus.

Rhomboid.

angles are right angles. Of course the opposite angles must be equal from the construction of the figure.

A *rhomboid* is also a parallelogram which is not right-angled, but bears the same relation to the rectangle which the rhombus does to the square, since it has the adjacent sides unequal. Here also the opposite sides and angles are equal.

RHOM'BIC SYSTEM. See CRYSTALLOGRAPHY.

RHONE (*Rhodanus*), a river which drains considerable portions of Switzerland and France, and is the only important river in the latter country which falls into the Mediterranean. It has its source under an ice-field on the Mont-de-la-Fourche (Furka Pass), near the St. Gothard, and within 4 miles of one of the sources of the Rhine, at an elevation of 5806 feet above the sea. Its upper course lies in the wide valley of the canton of Valais, through which it flows with great rapidity in a south-west direction, forming several cascades, and receiving many other impetuous mountain streams from the numerous valleys that open into its bed on either hand. Having reached Martigny, where it is joined by the Dranse, the river makes an abrupt bend to the north-west, and enters the eastern extremity of the Lake of Geneva, which it traverses in its whole length, depositing therein the mud that discoloured its troubled waters, and emerging at the city of Geneva in a clear stream of an indigo hue. This distinction, however, it retains only to its junction with the Arve, by which its waters are again defiled. On emerging from the Lake of Geneva the river resumes the original south-west direction, until it strikes against the rocky precipitous side of the Jura Mountains, whence, forming the boundary between France and Italy, it glances nearly southwards, through savage gorges, past Fort-de-l'Écluse, below which it forns (for a length of 300 feet) the subterranean channel called Perte-du-Rhône. Below the fort of Pierre-Châtel, in the south-east of the department of Ain, the Rhône again bends

sharply round to the north-west, leaving the frontier, and separating the French departments of Ain and Isère. From Lagnieu it runs first S.S.W., and then west to Lyons, where it receives into its rapid current the gently-flowing Saône on the right bank. From this point the course of the river is nearly due south past Vienne; Valence, above which the inky waters of the Isère enter it [see ISÈRE]; Avignon, not far from which it is joined by the impetuous Durance; Beaucaire; and Arles, where it divides into two arms that inclose between them the delta called Ile de Camargue—the more eastern arm (le Grand Rhône), throwing itself into the Mediterranean near the Tour St. Louis; the western one (le Petit Rhône) opposite the Saintes-Maries Isles. The great quantity of earthy matter carried down by the Rhône has pushed the coast of France, near its mouth, 9 miles further south than it was 1800 years ago. For its length it is probably the most rapid river in the world throughout its entire course, which extends, with all its windings, 640 miles. It is navigable *downwards* from near Seyssel to its mouth, a distance of 330 miles; for some miles higher up it is available for floating timber. Steamers ply between Lyons and the Mediterranean; but owing to the rapidity of the current the *up* navigation is very slow. The Rhône, however, is a most important highway for the transfer of the produce of this part of France. It was formerly useless for foreign trade owing to a bar of shifting sand at its mouth; but in 1870 a canal, 20 feet deep, was completed to connect the river with the Mediterranean at Golfe de Foz, between Cette and Marseilles, and a further scheme is in progress for improving the navigation. Canals also connect the river with the Bay of Biscay, the Rhine, the Seine, and the Loire. Its basin, including the Swiss cantons of Valais, Vaud, and Geneva, and fifteen French departments, most of which are famous for their corn, wine, silk, and oil, has an area of 38,000 square miles, and is included between the Alps, the Jura, the Vosges, and the Cévennes. The most important feeders of the Rhône on the right bank, besides the Saône, are the Ain, the Doubs, the Ardèche, and the Gard. On the left it receives the Gard, Isère, Drôme, and Durance. The river has a total fall of about 1000 feet from the Lake of Geneva to the sea. In the lower part of its course its waters are turned to great advantage in fertilizing the land near its banks by irrigation. Between Lyons and Arles it is spanned by several fine bridges.

RHONE, a department of France, formed out of the old province of Lyonnais, is bounded N. by Saône-et-Loire, E. by the departments of Ain and Isère, and S. and W. by that of Loire. Its greatest length from north to south is 63 miles; from east to west, 28 miles. The area is 1077 square miles, and the population in 1881 was 741,470. The department has a less area than any other in France, except that of Seine; but in density of population it ranks third, being exceeded only by the departments of Seine and Nord.

The surface is mostly mountainous. The main ridge of the Cévennes runs nearly north and south along the western boundary, and sends out several offshoots, which slope down to the Rhône and Saône, and cover nearly all the rest of the department. Vast numbers of house-fed goats are reared among these mountains; the cheese made from their milk is in great repute.

Hydrography.—The chief rivers are the RHONE and the SAÔNE, which form the greater part of the eastern boundary. The Andière enters the Saône a little east of Belleville; the Grône flows northwards out of the department of Rhône into that of Saône-et-Loire, and falls into the Saône a little below Varennes. The Gier is a feeder of the Rhône; several small affluents of the Loire rise within the western boundary; the largest of them is the Rhin. Particles of gold are found in the sands of several

of these rivers. The Canal of Givors, which unites Rive-de-Gier with the Rhône, is about 5 miles in length, and with the Rhône and Saône gives the department the advantage of about 80 miles of navigation. The department is traversed by the Lyons and St. Etienne Railway—which was one of the first constructed in France—and by the Paris-Lyons-Avignon line.

Natural Products.—The mountainous nature of the surface affords great variety of temperature; but the climate is generally healthy and favourable to vegetation. The high lands, especially the Mont Pila range, are covered with forests of oak, pine, beech, laurel, &c., while on lower sites the maple, the cistus, and many other southern plants flourish. In the extreme south of the department are the famous chestnut forests which yield the favourite large chestnuts sold in Paris by the name of *marrons de Lyon*. The valleys, plains, and accessible slopes are carefully cultivated, the products comprising almost everything that grows in France, except the orange and the olive. The cereal grains are chiefly wheat, maize, and buckwheat; of wheat the produce is not sufficient for the consumption. Potatoes, pulse of all kinds, madder, millet, saffron, flax, hemp, oleaginous seeds, and a great quantity and variety of fruits are grown. The mulberry is cultivated for the production of silk, but not to such a great extent as formerly. The lower slopes of the hills are almost everywhere planted with vines; this is especially the case with the slopes along the Saône and the Rhône, from the neighbourhood of Belleville to Condrieu. This region, which includes the Mont d'Or, so called from its rich wine products, contains some of the finest vineyards in France. The best sorts are those called Beaujolais, Côte-Rôtie, Romanèche, Condrieu, and Sainte-Foy. The nature of the soil admits of few horses, horned cattle, or sheep being kept. Asses are numerous and of good breed. Game and fresh-water fish are abundant. The wolf, fox, and badger are found among the mountains. Silkworms are reared very extensively.

The soil is rich in mines of copper, iron, and coal; besides which some veins of argentiferous lead are worked. Gold, manganese, rock crystal, porphyry, granite, marble, talc, asbestos, gypsum, fuller's earth, potter's clay, good building stone, and various other minerals are found. The Mont d'Or contains excellent stone quarries, and is noted for its great number of fossils. There are chalybeate springs at Neuville-sur-Saône, and at Charbonnières, near Lyons.

Industrial Resources.—The department is the most famous spot in Europe for all kinds of silk manufactures, including satins, taffeta, lute-strings, velvets, gold and silver brocade, crape, gauze, shawls, ribbons, hosiery, &c. This trade centres at Lyons, the capital of the department, from whence silks are sent to all parts of the world. There are also important manufactures of plain and figured muslin—principally at Tarare—handkerchiefs, silk hats, calicoes, cotton yarn and twist, blankets, gold and silver lace, small wares, straw hats, mineral acids, machinery and mill-work, and liquors. There are, besides, several dye-houses, bleachworks, type-foundries and printing offices, breweries, paper-mills, glass-works, potteries, and plaster mills. These various products, together with corn, wool, brandy, raw silk, broadcloth, linen, lace, hardware, hides, bar and sheet iron, ironmongery, timber, planks, staves, &c., form items of an extensive commerce, which is still further increased by the important transit trade carried on by means of the navigable waters of the department and by the railways. The department is divided into the two arrondissements of Lyons and Villefranche.

RHUBARB (*Rheum*), a genus of plants of the order POLYGONACEÆ, which includes the different species of plants yielding the stalks and root so well known. It has not, however, been clearly ascertained what species produces

the medicinal root, so long an important staple of commerce. The best, called Turkey Rhubarb, is obtained by the Russians at Kiachta from the Chinese.

The different species of rhubarb are important plants, not only on account of the roots being so extensively employed and so valuable for their medicinal qualities, but also because the stalks of the leaves, from their agreeable acidity, are largely used for culinary purposes. As the species are all indigenous in cold parts of the world, that is, in Southern Russia, Siberia, Tibet, the north of China, and the Himalayas, so they may all be grown in the open air of this country, and several are cultivated to a large extent. Some also, both in England and France, are grown on account of the root, which is sold as Turkey Rhubarb.

The species which are known and cultivated are the following:—

Rheum officinale.—In 1867 the Société d'Acclimatation at Paris received roots from a French missionary, which were said to come from Tibet, and to be the source of the true Chinese rhubarb. Some of the buds struck root, and from the plants which were raised seeds have been distributed to various botanic gardens, where it is cultivated under the name of *Rheum officinale*.

Rheum palmatum.—Linnæus described this species from specimens sent from Russia, which had been grown from seed procured from a rhubarb merchant. In 1872-73 it was found growing wild by Prejevalsky in Kansu, the extreme north-western province of China, and was recognized as the source of the Kiachta rhubarb. All the rhubarb collected for the European market appears to come from the provinces of Kansu, Szechueny, and Shensi, and to be the root of this species.

Rheum Rhaponticum.—This was the earliest rhubarb grown. It was cultivated at Padua in the beginning of the seventeenth century, and as early as 1628 in Parkinson's garden in England. It is a native of Central Asia. It is cultivated in England at Bunbury, and is called English rhubarb. It is also cultivated largely near Lorient, in the department of Morbihan in France, at a place called from that circumstance Rheunpole. *Rheum Rhaponticum*, *hybridum*, *undulatum*, and *palmatum*, are the common garden rhubarbs.

Rheum Emodi is found in Kumaon; the root is a valuable medicine, though bearing hardly any resemblance to that of the shops.

Rheum spiciforme is found on the northern face of the Himalayas. The roots are lighter-coloured and more compact than those of *Rheum Emodi*.

Rheum Mocroftianum.—This species was found by Messrs. Mocroft and Hearsay near the Niti Pass in the Himalayas, at an elevation of 12,000 feet.

Rheum leucorhizum, a small plant for the genus. The root is white and branched, though said to be equally efficacious with the best sorts.

Rheum undulatum and *Rheum hybridum*, with endless varieties produced by the art of the gardener, are propagated by seed, when the plants yield a crop in the second or third year, or more generally by dividing the roots. It prefers a light rich soil, and the ground ought to be heavily manured every year. The plants are placed 3 or 4 feet apart, according to the size of the variety. The smaller kinds are considered the best.

Medicinal properties of Rhubarb.—Like many other drugs rhubarb has a double action, as in small doses it acts as an astringent, confining the bowels, while in larger doses it acts as an aperient or purgative. Even where it acts as a purgative it is apt to be followed by constipation, owing to its astringent properties. The preparations of rhubarb are an extract, infusion, syrup, tincture, and wine, with a compound pill and compound powder, but some of these are very rarely used. The infusion is made by

infusing a quarter of an ounce of the root, pared into thin slices, in 10 fluid ounces of boiling water for an hour and then straining. It is peculiarly nasty to take, but it acts as an effective purgative when taken in doses of about a wine-glassful. The tincture of rhubarb is a favourite remedy for pain in the stomach, either attended by constipation or diarrhoea. The formula for the compound rhubarb pill is as follows:—Mix 3 oz. of powdered rhubarb, $2\frac{1}{2}$ oz. of Socotrine aloes in powder, and $1\frac{1}{2}$ oz. each of powdered myrrh and hard soap, with $1\frac{1}{2}$ fluid drachms of oil of peppermint, and 4 oz. of treacle. It is a very common and, when properly prepared, a very useful preparation. The compound powder, better known as "Gregory's powder," is a mixture of 2 oz. of powdered rhubarb root, 6 oz. of light magnesia, and 1 oz. of powdered ginger. Combined with alkalies rhubarb is a useful medicine in many forms of indigestion. Of the powdered root the dose as a stomachic is 1 to 5 grains; as a purgative, 10 to 20 grains. In connection with the use of this medicine it may be noticed that when taken in any quantity it turns the urine reddish-yellow, or, if alkaline, purple-red. Persons ignorant of this effect are sometimes frightened by the colour of the urine, imagining its high colour to represent a discharge of blood.

RHUMB or **RUMB** is probably the Latin *rhombus*; it seems to have signified originally the meridian, or the principal meridian of a map; perhaps it came to signify this from such meridian being usually ornamented by a distinctive rhombus, such as is added to the north direction on a compass-card. However this may be, a rhumb certainly came to mean any vertical circle, meridian or not, and hence any point of the compass; so that, in modern phraseology, a rhumb is one of the thirty-two principal compass directions, and to sail on any rhumb is to sail continually on one course. Hence a rhumb-line is a line drawn in the sphere, such as would be described by a moving point which always keeps one course.

RHUS (Sumach, in Greek *rhous*), the name of a genus of plants which has an extensive geographical range, from the south of Europe to the Cape of Good Hope. It is also found in Asia and North and South America. It belongs to the order *ANACARDIACEÆ*. Most of the species are poisonous, but they are much cultivated as ornamental shrubs, especially on account of the beautiful red colour of their leaves in autumn. Many of them are used also for the purposes of dyeing and tanning, as an astringent principle, to which is frequently added an acid, is common to the whole genus. The flowers are small, and generally either pistillate or staminate; the fruits are small and contain a single one-seeded stone. *Rhus Toxicodendron* (trailing poison oak, or swamp sumach), a North American trailing shrub possessed of peculiar properties. The leaves, which are trifoliate, thin, shining when fresh, of a dark green colour, are the only parts officinal in this country. But the leaves, branches, and flowers contain a milky juice which blackens on exposure to the air, and may be used as an indelible ink when applied to cotton or linen. Besides this very acrid milk, the plant, when not exposed to the sun's rays, by growing in the shade, or during the night, exhales a hydrocarbonated gas, which acts very potently on persons of a peculiar susceptibility when exposed to it. In two or three days after touching or being very near the plant, the skin inflames and swells, being attended with intense burning pain. The leaves, or an extract of the inspissated juice of this plant, have been recommended in several diseases, particularly herpes, paralysis, and consumption.

Rhus Cotinus (the Vennus sumach, or wild olive) is a very ornamental shrub, growing wild in the South of Europe. It is made use of, like many others of the species, for tanning in Italy, and is called *Scotino*. The wood, called Young Fustic, is used by the modern Greeks for dyeing wool, and produces a beautiful rich yellow.

Rhus typhina (the fever rhus, or stag's-horn sumach) is found in every part of North America, and its dark red leaves add much to the beauties of an American autumn. The fruit of this plant is exceedingly sour, and on this account it is frequently called Vinegar Plant, and is even used in some parts as a substitute for vinegar.

Rhus vernicifera (the varnish-bearing sumach, or Japan varnish-tree) is a native of Japan. Its leaves are very large and beautiful, rendering it one of the handsomest of shrubs. This is the plant which yields the celebrated Japan varnish.

Rhus venenata (the poison sumach, or swamp sumach) is a native of North America. It is a tall-growing shrub, with pinnate leaves, which are compound of eleven or thirteen leaflets. It is exceedingly poisonous, so virulent that it is said to affect some persons by merely smelling it. A touch will sometimes produce violent inflammation. It is a beautiful shrub, and well worthy of cultivation, but great care should be taken to prevent its being carelessly handled.

Rhus Coriaria (the tanning or elm-leaved sumach) is a native of the South of Europe, and is extensively used for the purpose of tanning. It is said that most of the leather made in Turkey is tanned with the bark of this species. The sumach of commerce consists of the finely ground leaves.

Rhus radicans (the rooting poison-oak, or sumach) is a native of North America. Its climbing habit, combined with the beautiful red colour of the leaf during the decline of the year, renders it one of the most picturesque of American plants. It frequently abounds in the forests, where it may be seen covering the tops of the highest trees. It climbs up walls and rocks, and runs upon the ground with equal facility, thus covering everything within the reach of its stems.

RHYL, a rising watering resort of Wales, in the county of Flint, situated near the mouth of the Clwyd, 10 miles N.N.W. of Denbigh, and 209 miles from London by the London and North-western Railway. It has a town hall, pier, winter gardens, and in the vicinity many interesting buildings. The fine sands are very favourable for bathing. The population in 1881 was 6029.

RHYME (*Rime*). Johnson derives this word from the Greek *rhuthmos*, and there is no doubt that the same confusion between rhythm and rhyme caused the latter to be misspelt in the present absurd fashion. The word is really *rime*, and it is impossible to find it otherwise spelt than *rime* or *ryme* before 1550, if even so soon as that. *Ryme* is Chaucer's; "rime" is Shakespeare's spelling (first folio). The Old English form is *rim*, and meant number or computation; the present use of the word to signify the correspondence of sounds at the ends of verses is derived from the cadenced or measured feeling on the ear; thus Pope uses the actual word number: "I lisped in numbers, for the numbers came"—meaning in rhymed verses. The word is akin to the Greek *arithmos*, number. It is very curious that while rhyme has adopted an *h* to which it had no right, *rime* (hoar frost) has lost the *h* which properly begins it, the word being truly *krime*. In mediæval times both words were spelt alike, as *rime* or *ryme*. The Greek and Roman poets did not use rhyme, and the word *rhythmos* was applied by both, in its poetical meaning, to the metrical arrangement of syllables, and not to the correspondence of sound in their terminations. Goethe, therefore, justly makes Greek Helena, in the second part of "Faust," pleased with the absolute novelty, to her, of the rhyming poetry her German lover unconsciously uses. Rhyme was not used either by the Celtic or by the early Scandinavian nations. As an accompaniment of verse, it cannot be traced further back among European nations than to the *rymours* of Normandy, the *troubadours* of Provence, the *minnesingers* of Germany, and the monks, who, after the fall of the Roman Empire, added rhyming terminations to the Latin metres

which were chanted or sung in the church service; as, for example, in the dirge commencing with—

"Dies iræ, dies illa,
Solvat sæculum in favilla;
Teste David cum Sybilla."

Rhyme was early employed by the Italian poets. The "Divina Commedia" of Dante, the oldest of the great Italian poems, is in alternate rhymes. The early Anglo-Saxon poetry is without rhyme, but is distinguished by the alliteration which marks every line. [See ALLITERATION, and also ASSONANCE.] All the earlier English poetry has rhymes, which are rude and imperfect, like the versification. There is no doubt much truth in Samuel Butler's biting definition of a couplet, as "One for sound and one for sense;" and as he says, so is it in fact—

"Rhymes the rudders are of verses,
With which, like ships, they steer their courses."
—*Hudibras*.

To the ordinary poet rhyme is a very tyrant, making him say what he would not, and preventing him from saying that which he would. Even with great poets the necessity of rhyme is often felt to be irksome; and many go far with Milton in his crushing condemnation of the use of rhyme for grave and lofty themes. Milton was himself a rhymster of extraordinary felicity, as witness "L'Allegro" and "Il Penseroso," &c., and yet, alluding to the Elizabethan tragedies in blank (unrhymed) verse, he says (prefatory note to "Paradise Lost"), "Rime is but the invention of a barbarous age to set off wretched matter and lame metre; graced indeed by the use of some famous modern poets, and away by custom, but much to their own vexation, hindrance, and constraint to express many things otherwise, and for the most part worse than else they would have expressed them. Not without cause, therefore, some, both Italian and Spanish, poets of prime note have rejected rime both in longer and shorter works, as have, also long since our best English tragedies, as a thing of itself to all judicious ears trivial, and of no true musical delight, which consists only in apt numbers, fit quantity of syllables, and the sense variously drawn out from one verse into another, not in the jingling sound of like endings—a fault avoided by the learned ancients, both in poetry and in all good oratory. (This poem) . . . is to be esteemed an example set, the first in English, of ancient liberty recovered to heroic poem, from the troublesome and modern bondage of riming."

Without going to Milton's length it is quite evident that the "jingling sound of like endings" tends more and more to be skilfully veiled by varying rhythms and intricate rhyme-schemes in the present day. The rattle of the couplet, except for comic writing, is almost abandoned. Delicately used, and with the utmost apparent ease, rhyme is too welcome to our ears to be now discarded, in spite of its many faults and difficulties.

When two successive rhymes occur they form a *couplet*; three, a *triplet*; and if lines rhyme alternately, or at regular intervals, they are described as *quatrains* and *irregular stanzas*. Tennyson has popularized a peculiar arrangement of the quatrain, in which the first line rhymes with the fourth, and the second with the third. Other groups of lines, commonly used in English poetry, are the *sonnet* and the *Spenserian stanza*.

RHYMER, THOMAS THE, the name given to one of the earliest poets of Scotland, whose history is involved in much obscurity, but who is believed to have flourished towards the close of the thirteenth century. His name appears to have been Thomas Learmount of Ereildoun, a village in the county of Berwick, situated on the river Leader; but in an ancient charter his son calls himself "Filius et hæres Thomæ Rymour de Ereildon," while Blind Harry refers to him as Thomas the Rhymer. During his lifetime he was celebrated more for his prophetic than his

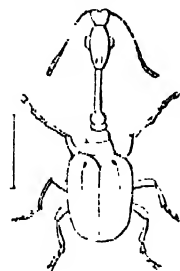
poetic powers, and some of his obscure utterances were supposed to so exactly foreshadow certain public events as to gain for him the appellation of "True Thomas," and to give rise to the belief that he derived his knowledge from the fairies. The most famous of his prophecies was one by which he was regarded as foretelling at Dunbar the death of Alexander III., king of Scotland, which took place within the time indicated by him at Kinghorn. At a later period the tradition of his intercourse with the fairies was elaborated into a story, which represented him as being carried off at an early age to Fairyland, where he became a favourite of the fairy queen. During his stay he acquired the supernatural powers which afterwards rendered him famous, and then he returned, by permission, for a period of seven years, to his former home. During this period his marvellous gifts excited the wonder and admiration of his countrymen, and he was growing in reputation and influence when he was summoned to return. Feasting at Ereildoun with his friends, a villager came running to the tower with the news that a hind and hart had left the neighbouring forest, and were quietly and fearlessly walking through the village. Thomas at once rose, with the words that "his sand had run," and that was the sign for his return; and leaving the tower his friends saw him follow the hind and hart into the wood, whence he was never seen to emerge again. The Eildon Tree, beneath which he was said to have delivered his prophecies, has disappeared, but the spot is marked by a stone called the Eildon Tree Stone, the name of the neighbouring streamlet, Bogle Burn, being also derived from his fairy visitors. Allusions to Thomas the Rhymer are to be found in several ancient Scottish manuscripts, and in 1603 some of the poems popularly ascribed to him were printed at Edinburgh by Waldegrave, as a portion of the book entitled "The Whole Prophecies of Scotland, England, Ireland, France, and Denmark, prophesied by Thomas the Rhymer, Marvellous Merling, Beid, Berlington, Waldhave, Eltrain, Bannester, and Sybilla." In the poems of Robert of Brunne there is an allusion to a version of the story of Sir Tristrem prepared by Thomas the Rhymer, and at the beginning of the present century a MS. found in the Auchinleck collection was pronounced by Scottish antiquaries to contain the long lost work. There does not appear to be much reason for this supposition, but the MS. was edited by Sir Walter Scott, and issued as the work of the Rhymer in 1804.

RHYNCHOPHORA is a large group of beetles belonging to the section **TETRAMERA**. It is distinguished by having the head produced into a rostrum or snout, which is sometimes three times the length of the body. This is a large group of vegetable-feeding beetles, the majority belonging to the family Curculionidae or **WEEVILS**, very common in all temperate and tropical countries. The larvæ are footless, and many spin a silken cocoon in which to pass the pupal stage. Three other families are included in the Rhynechophora, **BREXTHIDÆ**, **BUTCHIDÆ**, and **Anthribidæ**, the species of the last-named family living chiefly on the bark of trees.

RHYNCHOPS. See **SCISSOR-BILL**.

RHYNCHOTA. See **HEMITERA**.

RHYOLITE (Gr. *rhua*, a lava stream; *lithos*, stone), a highly silicated lava belonging to the granite-group of igneous rocks, and so named by Baron von Richthofen in 1860. The rock is porous and rough, and is chiefly composed of brownish or grayish glass substance, in which are scattered distinct crystals of **QUARTZ**, **SANDWINE**, &c. The different varieties are often referred to under the



Anthribus Zamia.

general name of *Trachyte* (Gr. *trachus*, rough), the nature of the porphyritic mineral in each case being indicated by compound terms, such as *quartz-trachyte*, *scandine-trachyte*, &c. Both has also given the name of *Liparite* to similar rocks occurring in the Lipari Islands.

RHYTHM (Gr. *rhythmos*, measure, proportion) is the grouping of accents. It is most clearly seen in music, where it is the basis of what is called *time*, the relative proportions of notes in a single bar; and secondly, in a more general sense, rhythm, in music, expresses the relative proportion of a number of bars in any given portion of a composition, such as in either half of a minute or of a march. Rhythm is the most important constituent of music; with it inarticulate sounds are productive of musical effect, as when a drum beats for soldiers to march to. In melody, that is, in a succession of measured sounds, notes are the component parts of a bar, and bars are the component parts of a strain, or musical period, or phrase. The due relative proportion of all these is absolutely necessary in the formation of a good musical composition. Similar remarks, *mutatis mutandis*, apply to poetry and to dancing.

RHYTINA is a genus of mammals belonging to the order SIRENIA. Steller's Rhytina (*Rhytina stelleri*) is the only species of the genus, and is now extinct. It was discovered during Behring's arctic expedition in 1741 by the naturalist Steller, who accompanied that traveller, on the shores of two small islands in the North Pacific, Behring's Island and the adjacent Copper Island. Steller perceived its relationship to the MANATEE (*Manatus*), and described it under the name of Northern Sea Cow (*Pacca marina*). Unfortunately such numbers were destroyed by the sailors for food, that twenty seven years afterwards, in 1768, this interesting mammal became extinct. The Rhytina was much larger than the living Sirenians, the Manatees, and Dugongs, attaining a length of from 20 to 28 feet. The body was covered with a very thick, rugged bark-like epidermis, the dermis or true skin being comparatively thin; it was of a deep brown or purplish-black tint. The head was very small; but the tail was large, oval in shape, and terminated in a horizontal, stiff, crescent-shaped, narrow fin blade. The fore limbs were short and truncated, hairy at their tips, with no separate digits. There were no teeth, but their place was taken functionally by dense, strongly ridged, horny plates. The Rhytina lived on sea-weeds, and was seen usually in families. Their inoffensive, affectionate, disposition contributed to their extinction.

RIAZAN', a town of Russia, the capital of the government of the same name, situated on the Timbosh, a branch of the Oka, is a well-built town, surrounded with palisades. The population is 30,000. This city has greatly increased in size and importance within the last fifty years, and now consists of two distinct portions—the fortress, containing the cathedrals, the episcopal palace, formerly the residence of the princes of Riazan, and the consistory; and the town proper, which has numerous churches, several convents, government offices, hospital, society of arts, a school of drawing and architecture, a clerical seminary, a gymnasium, and manufactories of woollen cloth, linen, sail-cloth, leather, glass, iron wares, and needles. There is a large trade in corn. The old town of Riazan, destroyed by the Tartars in 1568, is distant about 33 miles south-east.

RIB, in anatomy. See BACKBONE.

RIB, in Gothic architecture, a projecting band or moulding, employed to relieve a flat or arched ceiling. It was introduced in great abundance and variety in the later styles of Gothic, especially in the Perpendicular.

RIB-GRASS. See PLANTAIN.

RIBALTA, FRANCES CO, a celebrated Spanish historical and portrait-painter, born at Castellon de la Plana in 1551. After studying some time at Rome he settled in Valencia, where he earned a great reputation, and where the majority of his finest works are still pre-

served, comprising some important altar-pieces and other religious works, his drawing, coloring, and composition being all of a superior character. He was the first chief master of the more famous RIVERA (*Lo Spagnoletto*). His style somewhat resembles that of Sebastian del Piombo, whose works formed the chief subject of his studies in Rome. Ribalta died in 1628.

RIBBON signifies a long narrow web of silk worn for ornament and use. Ribbons of linen, worsted, gold, or silver thread were formerly included in the term, but it is now generally confined to those made of silk.

Paris, Tours, Lyons, and Avignon were originally the chief seats of the ribbon trade; the last two cities were rivals until the year 1723, when, partly owing to the regulations which the jealous Lyonnese had prevailed upon the government to make in their favour, and partly to a plague of two years' continuance, the trade of Avignon was ruined, and in great measure transferred to Lyons. At Paris the master ribbon-weavers were incorporated into a company, under the designation of *tissutiers rubaniers* of the town and suburbs of Paris. Figured ribbons were made chiefly at Paris. The ribbons called *double lisse* (double warp), which were considered the richest and best, were made at Tours. Before the revocation of the Edict of Nantes, the ribbon-loom of Tours amounted to 3000; but this measure, which banished the Protestants, banished with them their trade, and both Tours and Lyons suffered severely from its effects, but the trade of Lyons afterwards revived.

The making of ribbons and small articles in silk long preceded in England that of broad silk. The trade was principally in the hands of women, and, like a sickly plant of foreign growth, it appears to have constantly demanded props and support, which, however, were removed by the French Treaty of 1861.

Figures on ribbons, as in other fabrics, are chiefly formed by omitting the regular crossing of the warp and shoot in such a manner that a difference of texture shall occur in the web so as to mark out any pattern. This is effected in the single-hand loom by a multiplication of treadles connected with the lisses, by which the different portions of warp are alternately raised. Forty treadles have been sometimes required to form an intricate pattern. Small figures produced in this manner are called *leys*. To execute more complicated patterns an intricate arrangement of the loom is necessary.

Ribbons are made according to a fixed standard of widths designated by different numbers of pence, which once no doubt denoted the price of the article, but at present have reference only to its breadth. The French distinguish their widths by simple numbers. All dressed ribbons, as satins, gauzes, &c., are made in the loom one-twelfth of an inch wider than sarsonets, in order to allow for the diminution of breadth which results from the lengthwise stretching which they receive in the operation of dressing. Fine gauzes require an allowance of two-twelfths. French fancy ribbons are generally made and sold in *garmitures*, that is, a broad and narrow piece taken together of the same pattern. *Sarsenet* and *lutestring* ribbons are made by the simple and regular alternation of the warp and shoot, as in plain cloth, called technically *ground*. By *grogan* (Fr. *gros-grains*) is meant a variation in the texture, caused by the warp-threads passing over two of the shoots at once, taking up one only: this often finishes the edge of a ribbon.

The figures are frequently produced in a different colour from the ground by the mixture of colours in the warp, the colours being warped separately. In the intervals of the figures the coloured threads are carried along the under side of the ribbon, and it is said to have a double or treble figure, according to the number of colours passing through each dent. A change of colour in the shoot is effected by

the use of different shuttles. In brocades the figure is made by small additional shuttles, thrown in partially across the ribbon as the pattern may require, the connecting threads of shoot being clipped off. By *damask* is meant the laying the warp over the shoot to form the figure in the manner of satin. Some fancy ribbons are of plain texture, but varied in colouring; they are shot or woven in shades, stripes, bars, or cheques, called in the trade *pluids*. In shot ribbons the warp and the shoot are of different colours. *Clouding* is a peculiar management in the dyeing, by which a change of hue is produced in the same thread of silk. In *Chine* ribbons the figures are printed or painted on the warp after it is prepared for the loom, and afterwards woven in by the shuttle. Ribbons are watered by passing two pieces together between two cylinders, one of which has a heater within it. *Galloons* and *doubles* are strong thick ribbons, principally black, used for bindings, shoe-strings, &c. The narrow widths are called galloons; the broader, doubles. *Ferrets* are coarse narrow ribbons shot with cotton, used for similar purposes. In *gold* and *silver* ribbons a silk thread of similar colour is wound round by a flattened wire of the metal, and afterwards woven. Lyons was particularly celebrated for its fabrics of this kind.

RIBBON-FISH (Trachipteridae) is a family of fishes belonging to the order ACANTHOPTERYGII, distinguished by their long ribbon-shaped body. The body is excessively elongated, sometimes exceeding 20 feet in length, scaleless and greatly compressed, being in the largest forms only about 12 inches deep and 2 inches broad at the thickest part. The dorsal fin extends the whole length of the back, and has a detached portion on the head composed of very long flexible spines. There is no anal fin. The caudal fin is rudimentary or directed upwards. The ventrals are thoracic, and are either small and composed of six rays, or consist of one or two very long filaments. The head is deep and short, and the mouth is small and armed with very feeble teeth. The ribbon-fishes inhabit deep waters in all oceans; they are generally obtained after storms, when they are thrown dead or dying on the shore, or are found floating dead on the surface. They are rarely seen except in a more or less mutilated condition, as the expansion of the guses within the body, caused by the reduction of the pressure when the fish rises to the surface, disorganizes the muscles and the feebly developed skeleton. Young ribbon-fishes are sometimes met with near the surface with the fin-rays enormously developed in proportion to the body.

Three genera are included in this family. Of the genus *Trachipterus*, which has well-developed ventral fins, consisting of several branched rays, one species, the *DEAL-FISH* (*Trachipterus arcticus*) is often found after storms on the northern coasts of Britain. The genus *Stylophorus* has no ventral fins, and the tail terminates in a cold-like appendage, twice as long as the body. It is known only from one specimen, 11 inches long, found at the beginning of this century in the Gulf of Mexico, and preserved in the museum of the Royal College of Surgeons. The genus *Regulecus* has each ventral fin reduced to a long filament, and the caudal rudimentary or absent. One species, the *OAR-FISH* (*Regulecus bankii*), is taken occasionally on British coasts.

RIBBONISM, the name taken by a system of secret associations (from a badge of green ribbon worn by the members) which arose in Armagh, Ireland, about 1808, and which afterwards spread throughout the greater part of the country. Ever since the organization of the *WHITEBOYS*, who appeared about 1759 or 1760, Ireland has been more or less pervaded by secret societies, designed either for agrarian or political purposes, or for both combined. The United Irishmen, who followed the Whiteboys, were political conspirators, who aimed at obtaining the inde-

pendence of the country; and after the suppression of the rebellion an organization, known as the *Threshers*, was formed, the members of which asserted their chief objects to be resistance to the payment of tithes and the regulation of the prices of the necessaries of life. The chief object of Ribbonism seems to have been to fight the landlords, and though its members endeavoured to imitate the Orangemen in organizing their society, they do not appear to have aimed, as has been supposed, at the extermination of Protestantism. The Ribbon societies bound all their members by an oath of secrecy to be true to each other, and to obey the behests of their leaders, and they devised a system of signs, grips, passwords, &c., whereby members generally might recognize each other. They never possessed the power of combined action which was secured by the Orangemen, but all the separate lodges were affiliated to a Central Grand Lodge, the headquarters of which were in Tippetary County, the principal centres of operation being successively King's County, Queen's County, Meath, Westmeath, and Monaghan. The Ribbonmen used their power in intimidating landlords, agents, and employers of labour, in resisting evictions, evading the excise, and in punishing those who refused obedience, or who took land from which a tenant had been evicted. Minor offences were dealt with by local lodges, but when capital punishment was to be inflicted a wider extent of the organization was required to pronounce sentence and provide the means of assassination. Mutilation of cattle, arson, and murder were the means used by the Ribbonmen to gain their ends, and a number of desperadoes were retained in order that they might be sent to carry out any murder that had been decreed, the instruments of the crime being always strangers from a distance. The society did not become formidable until about 1820, but for the next twenty-five years it exercised great influence over the social life of Ireland. The impression that it was chiefly a political and Catholic institution led to the appointment of a Committee of the House of Lords in 1839, but the evidence taken by the Committee effectually cleared the Roman Catholic hierarchy and priesthood from any complicity in the organization. The evidence also proved that the members of the Ribbon lodges were almost entirely drawn from the very lowest classes. By the Westmeath Act of 1871 Ribbonism was declared illegal, but its influence had declined before this, and its place had been taken by newer associations, among which the most important was the Fenian Society. [See *FENIAN*, *FENIANISM*.] The latter still exists and possesses an extensive organization in the United States, but except for the encouragement of outrage and assassination given by its more disreputable section it is no longer formidable, either politically or socially. The agrarian war has also abated somewhat in its severity, owing to recent legislation, and the societies which have recently been formed to oppose the landlords have had leaders of some repute and standing, and have professed to carry on the conflict within the limits of the law. The shameful agrarian crimes which still unhappily disgrace some districts in Ireland appear rather to be the results of local savagery than the work of any regularly organized society, though the Moonlighters possess sufficient cohesion to enable them to overawe some considerable districts. For a singularly interesting account of the working of the Ribbon conspiracies, see Trench's "Realities of Irish Life" (London, 1868).

RIBERA, JOSEPE (i.e. Joseph), who was formerly better known by his sobriquet of *Lo Spagnoletto* (the little Spaniard), was a painter of high merit, who, though Spanish by origin, was entirely Italian by training and proclivity. Ribera was born at Cativa (now called San Felipe), near Valencia, in 1588, and was educated for the law, but neglected his studies for drawing. Eventually he entered the school of Ribalta. Here he learned that the headquarters of art was in Italy, and to Italy he made his

way. He almost starved, but managed to find subjects for his improvement in the frescoes of the churches and the streets, when he drew from them in the open air. He was thus found by a cardinal, who took pity on Lo Spagnoletto and gave him shelter. But the lad was too independent and too eager for better opportunities in art to stay there. He ran away, and managed by making himself useful to get a footing in the studio of the famous Caravaggio. Here he completely adopted the "naturalist" style of his master, and in a few years almost, if not quite, equalled Caravaggio himself. In fact the work of the two painters is with difficulty distinguished. Caravaggio was very good and generous to him till his death in 1609. Then Ribera went to Parma to study the works of Correggio, and paintings by him in that style are shown at Madrid. Later on he went to Naples as a permanent home, and resumed the methods of Caravaggio with the excessive contrasts of light and shade and the other tricks of the naturalists. A business-like father-in-law exhibited Ribera's works to the Spanish public in Naples, and soon had the pleasure of procuring his son-in-law orders from the viceroy at Naples, and through him from King Philip IV. himself. Ribera soon became not only wealthy, but powerful, and he was able to either keep away or send away any artist of high fame (such as Guido, Domenichino, &c.) who desired to come, or really came to Naples. He resorted even to violence in the extraordinary and degrading jealous greed which had now seized him. His daughter married a Spanish noble, and he himself, triumphant till the end, died in Naples in 1656.

It is a great pity that such a near ending came to an undoubtedly fine genius, but it is of course quite possible, and is certainly necessary, to dismiss the man's moral character from the mind when regarding his work. Looked at purely artistically, Ribera's pictures cannot fail to please by their massiveness and strength. Though tricky, he is undeniably great. His subjects are frequently of the tragic, and almost always of the violent order—martyrdoms, executions, and the like. His most famous pupil was Salvator Rosa. He is very poorly represented in the National Gallery; his finest works are at the Louvre, at Naples, and at Madrid.

RIBES is a genus of plants belonging to the order Saxifragæ. It is well known as producing the **CURRENTANT** and **GOOSEBERRY**, and also for affording many of the ornamental shrubs of our gardens. The calyx is coloured and has five segments; there are five small distinct petals, the same number of stamens, which are free and spring from the throat of the calyx-tube; the fruit is a berry with several seeds. About sixty species have been described, the majority of which are found in America in temperate climates, from the Arctic regions to Cape Horn; the remainder are found in temperate Europe and Asia.

Ribes oryanthoides (hawthorn-leaved gooseberry) is a native of the rocky districts in Canada, and bears a fruit very much resembling that of the common gooseberry both in appearance and taste.

Ribes Grossularia (common gooseberry). This plant does not appear to have been known to the ancients; and the earliest author who mentions it is Matthioli, an Italian botanist. It was recorded as existing in England by Turner, Parkinson, and Gerard; but Ray is the first writer who mentions it as a cultivated species. The Dutch were the first to cultivate the gooseberry successfully, but even up to the time of Miller it seems to have gained very little repute in England as a fruit for the table. From its extensive cultivation, it has received a great variety of names. In Cheshire and the north of England it is called *Feverberry*, in Norfolk *Feaves*, both of which names are corruptions of fever-berry, as, according to Gerard, it was at one time considered to be a specific against fevers. *Grozel*, a common name for it in Scotland, seems to be derived from

the French name *Groseille à Maquereaux*, again derived from the Latin *Grossularia*, and referring to the use of the fruit as a sauce with mackerel. *Gooseberry* is probably a contraction from *gros(cill)berry*: the prickly branches have also suggested the derivation *gorseberry*.

Ribes rubrum (common red currant). In France the red currant was cultivated long before the gooseberry, but was first produced in perfection by the Dutch. Gerard mentions that they were cultivated in gardens in his time.

Ribes nigrum (black currant). The peculiar strong smell of the leaves of this plant are very characteristic. The fruit of the black currant is not in so great repute as the red, and is comparatively of modern introduction. It is sometimes used as a medicine. The leaves and fruit are diuretic.

Ribes sanguineum (bloody or red-flowered currant) is a native of the north-west coast of America, and has been extensively cultivated in Great Britain.

RIBSTON PIP-PIN, a famous hard-fleshed English apple of remarkably fine flavour, but of not very handsome appearance. Its dull-green coat, with slender ruddy streaks, badly heralds the delicious fruit inside. It is a true pippin; that is, an apple raised originally from seed (*Fr. pépin*, seedling), afterwards propagated by grafting in the usual way. Sir Henry Goodricke planted three pips of a fine Norman kind, sent to him from Bouen, at Ribston in Yorkshire; two died, but the third is the parent of all the many Ribston pippins in England.

RICARDO, DAVID, a distinguished political economist, was born in London on the 19th of April, 1772. His father was a native of Holland, but the family, which was of Jewish descent, is said to have come originally from Lisbon. The elder Ricardo had gained a fortune on the Stock Exchange, and gave his son David a plain commercial education, intending him for the same occupation, and at the early age of fourteen began to employ him in Stock Exchange business. The boy soon showed a thoughtfulness and independence of judgment which, before he was twenty, led to his relinquishing the Jewish faith, in which he had been brought up; and as soon after coming of age he married contrary to the wishes of his parents, he was abandoned by his father and thrown on his own resources. His remarkable business capacity, however, soon placed him on the highroad to fortune, and as his position became assured, he turned his attention more and more to those scientific and literary pursuits in which he had from boyhood shown a marked interest. He was one of the original members of the Geological Society; but it was not until he came across the "Wealth of Nations," which he is said to have only done in 1799, that he found the study most congenial to him, and political economy soon absorbed his whole leisure.

It was only in his thirty-seventh year that Ricardo began his career as an author. The serious rise in the market price of bullion in 1809 led to his investigating the subject, and his practical knowledge and economic studies together enabled him to grasp the true cause of the phenomenon. His views first appeared in the shape of letters to the *Morning Chronicle* towards the end of 1809, and attracted so much attention that he expounded them more fully in a pamphlet entitled "The High Price of Bullion, a Proof of the Depreciation of Bank-notes," which probably helped to secure the appointment of the Bullion Committee a few months later. In this work Ricardo pointed out that as long as the currency of a country consists only of gold and silver coin, or convertible paper, the rise or fall of the rate of exchange is restrained by the flow of bullion to or from other countries; but that as an inconvertible paper currency, such as ours was at that time, is subject to no such check, the high price of bullion clearly pointed to an over-issue of paper money. The principles laid down by him were substantially embodied in the report of the Bullion Committee,

and thus received great additional weight; while another pamphlet, during the discussion which followed, in answer to Mr. Bosanquet, further established his reputation.

Ricardo's intimacy with Malthus and James Mill, the author of the "History of British India," both well-known economists, which began about this time, no doubt helped to concentrate his attention even more than before on political economy; and in 1815 he published an "Essay on the Influence of a Low Price of Corn on the Profits of Stock," in which he expounded the doctrine of RENT now associated with his name, and founded on it an argument in favour of free-trade in corn just when a bill was being passed raising the limit of price at which the importation of foreign corn should be permitted to 80s. a quarter. He soon afterwards retired from business, and in 1817 produced his great work on the "Principles of Political Economy and Taxation," a closely reasoned treatise.

In 1819 Ricardo entered Parliament as member for Portarlington, and soon gained very great influence both from the mastery which he displayed of economic questions, and his disinterested zeal for the public good. He took an independent position, and although he generally voted with the Whigs, he favoured vote by ballot as the only security for independence in the mass of voters. He was also in favour of defraying the cost of a war within the year by an increase of taxation, and proposed that the national debt should be paid off by an assessment on capital.

In 1822 Ricardo published an able pamphlet on "Protection to Agriculture," in which he exposed the fallacious arguments used in its favour. This was the last work published before his death, which occurred somewhat suddenly at his seat at Gatecomb Park, Gloucestershire, on the 11th of September, 1823, from inflammation of the brain brought on by disease of the ear. Although Ricardo died at the comparatively early age of fifty-one, and had had many disadvantages to contend with in early life, few men have achieved so much. He was a man of modest and unassuming manner, which disarmed hostility; while the originality, clearness, and skill which he showed in dealing with the most abstruse questions of political economy, both in his writings and speeches, established his position, not only as the leading economist of his day, but as one of the most important founders of the science in England.

RICE (*Oryza sativa*), unlike many long-cultivated grains, is still found in a wild state in and about the borders of lakes in Hindustan, though never cultivated, because the produce is said to be small compared with that of the varieties in cultivation. The grain is, however, remarkably white, palatable, and reckoned very wholesome; hence it is carefully gathered, and sells dear. The rich esteem it a dainty, and, to make it still more delicate, boil it only in steam. The rice plant is therefore an undoubted native of Hindustan, from which country it has spread over a great part of the world, especially in Asia, where it forms the principal portion of the food of the inhabitants; but it has also from very early times been introduced into the southern parts of Europe. De Candolle, in the "Origin of Cultivated Plants" (1883), allows that, in India, a knowledge of it dates from the invasion of the Aryans, since it has the Sanskrit names *vrīhi* and *arūnya*, whence come several of the modern Indian names, as well as *orūza* of the ancient Greeks, and *arous* or *rouz* of the Arabs. Though he thinks it highly probable that it is indigenous there, he seems inclined to think that it was cultivated at an earlier period in China than in India. In the ceremony instituted by the Emperor Chin-Nong (B.C. 2800), rice plays the chief part; for it is only the emperor himself who may sow it, while the princes of his family may sow the other four species.

Rice is no doubt the grain which yields food for the largest portion of the human race, but even in Hindustan

great numbers do not eat it. In fact, in all the north-western provinces wheat is the principal crop, and the natives eat wheaten cakes. It contains about seventy-six per cent. of starch, and therefore cannot be baked into bread; but it is more easily cooked. It is light and wholesome and easily digested, and might form a much larger portion of the diet in Europe than it does. Europeans in India eat it at breakfast as well as at other meals, and with fish as frequently as with their curries. "Rice is most usefully employed as food when it is consumed along with substances rich in nitrogenous or flesh-forming matters. Thus it may be used with meat, eggs, and any kind of pulse, as pease or beans. Rice should not be boiled, but merely steamed till tender, for it yields to boiling water a considerable part of its nitrogenous and mineral constituents—these compounds, in fact, in which it was already deficient. But this objection to boiling rice does not apply to its use in soups" (Professor Church in *Food*).

Of the kinds imported into England the Carolina is the best, which is grown in the marshy grounds of North and South Carolina. The grains are shorter, broader, and boil softer than the Patna rice, which is the best Indian kind known in this country, though in that country there are several superior varieties, as, for instance, the Pilibet, which are much more esteemed there.

In 1885 the quantity of rice imported into the United Kingdom was 5,588,650 cwt., value £2,185,664, or about 7s. 6d. per cwt. Nearly the whole supply is received from Burma and Bengal. The quantity exported from Great Britain in 1885 was 3,132,725 cwt., chiefly to Holland, Belgium, France, Portugal, Cuba, and the United States.

RICE PAPER, a substance prepared from the central cellular portion of the stem of *Fatsia papyrifera*, one of the ARALIACEÆ. The stem of the plant is cut in longitudinal spirals, so as to form sheets of the so-called rice paper, the cellular structure of which is easily seen under the microscope. It appears to grow only in Formosa, whence it is exported to China. It is used as a material for painting upon, and for the manufacture of several fancy and ornamental articles. It is sometimes erroneously stated to be prepared from rice.

RICE-BIRD (*Oryzornis oryzivora*) is a species of Finch (FRINGILLIDÆ) to which the names Paddy Bird and Java Sparrow are also given. It is about the size of a greenfinch, which it further resembles in the thickness of its bright red bill. The plumage of the back and breast is



Rice-bird (*Oryzornis oryzivora*).

of a fine bluish-gray colour; the belly is pale rose; the head and tail are black; the cheeks in the male are snowy, and the legs are flesh-coloured.

In Java, where it is called Glate, and the other parts of Asia where it is found, it has a very bad reputation on account of the ravages which it commits in the rice-fields

with its powerful and sharp bill. It is often brought alive to this country, and confined in aviaries for the sake of its elegant shape and graceful colouring: its song, which is short and monotonous, does not much recommend it. This species must not be confounded with the rice-bird of America or *BON-O-LINK* (*Dolichonyx oryzivorus*).

RICE-MILL. When rice has been cultivated and gathered some sort of mechanism is requisite for the removal of the husk. The Chinese and Hindus beat the grain in a kind of rude mortar of stone or earthenware, with a conical stone attached to a lever worked by the hand or foot. This process being uncertain and tedious, the preference is usually given to a kind of mill, in which the stones are placed at such a distance asunder as to detach the shell without crushing the grain; the stones being inclosed in a case which prevents the dispersion of the rice by the rapid rotation of the machine. The current of air catching the "paddy," or uncleaned rice, as it lies between the stones, whirls it about until at some point of the revolution it comes vertical, when the husk is immediately cracked and falls from the grain; while so exactly are the stones adjusted, and so neatly are all the grains of one sample the same size, that when ones husked the rice is too short to reach between the stones. If a long grain does so reach it is of course snapped in halves. The rice is thrown out of the case by an opening in its side, and conducted over a sieve that separates the dust; after which it is made to fall in a gentle stream exposed to a current of air produced by revolving fans, and is thereby separated from the husk. After the removal of the husk the grain is exposed to the action of a whitening machine, a grindstone turning vertically, which grinds off the inner cuticle, or red skin, remaining on the surface of the grain. The art of the rice-miller consists in watching these stones so as to know when the grain is sufficiently ground to be a good colour, and yet not too much ground so as to lose in size, the fineness of rice depending in size as well as colour. The refuse of the rice-mill forms the best pig-food known.

RICHARD I., King of England, surnamed *Cœur de Lion*, was the third son of Henry II. and his queen Eleanor, and was born at Oxford, in the king's manor-house there, afterwards the monastery of the White Friars, in September, 1157. At eleven he was made Duke of Aquitaine, and his love of chivalry and the troubadour's "gay science" dates from his boyish career in France. In 1173 he joined the league against his father, but was pardoned by Henry in 1174, and betrothed to Alice, daughter of Louis VII. of France. The death of his elder brother Henry made him heir to the crown of England in 1184. Henceforward his life was one long quarrel with his father, and eventually Richard took up arms against Henry in conjunction with Philip Augustus, king of France, whom he had conciliated by doing homage for the English provinces in France. The old king died heart-broken at the unfilial and unpatriotic conduct of his sons, and Richard became King of England, July, 1189.

After the death of his father, Richard made no particular haste to come over to England. His coronation did not take place in Westminster Abbey till 2nd September. Richard had before his father's death joined the Third Crusade, and he now raised as much money as he could, by means somewhat unscrupulous, and left England 11th December, 1189. Proceeding to Normandy, he united his forces with those of Philip Augustus in the plain of Vezelai, 1st July, 1190. The crusaders proceeded, by different routes, to Messina, where they remained till the end of March, 1191. During their stay Richard compelled Tancred, who had usurped the crown of Sicily, to relinquish the dower of his sister Joan, the widow of William, the late sovereign, and to pay him besides 40,000 ounces of gold. In return he betrothed his nephew Arthur, the son of his next brother, Geoffrey, to Tancred's infant daughter, and

formed a league, offensive and defensive, with the Sicilian king, a connection which afterwards cost him dear, for it was the source of the enmity of the Emperor Henry VI. After the dispute with Tancred had been settled, the latent rivalry of the two monarchs broke out in a quarrel about the Princess Alice of France, the sister of Philip, to whom Richard had been betrothed, but whom he now forsook for Berengaria, the beautiful daughter of Sancho VI. of Navarre. This quarrel, which, however, was ultimately settled by certain concessions on the part of Richard, caused the separation of the two kings, and Philip proceeded to Palestine alone.

Isaac Komnénos, the king of Cyprus, having ill-used the crews of some English vessels which had been cast upon his coasts, Richard made an attack upon that island, which ultimately surrendered to him. Having married Berengaria, Richard set sail from Cyprus on 4th June, 1191, with a fleet consisting of thirteen large ships, called buses, fifty galleys, and 100 transports; and on the 10th he reached the camp of the crusaders assembled before the fortress of Acre, which surrendered on 11th July. This great event, however, was immediately followed by an open rupture between Richard and King Philip, and the return of the latter to France in August.

Richard performed prodigies of valour in the Holy Land; but although a signal defeat of Saladin, 7th September, was followed by the capture of Jaffa and some other places of less importance, Jerusalem, so far from being taken, was not even attacked. Richard came within sight of it on Christmas Day, 1191, but his French and German allies now deserted his leadership, and in a fury of rage at his impotence, he was obliged to retire to the coast after a second attempt in July, 1192. He retook Jaffa, which Saladin had seized, on 1st August, and this was his last exploit in the East. On 9th October, 1192, Richard set sail from Acre in a single vessel; his fleet, with his wife, his sister, and the daughter of the captive King of Cyprus on board, having put to sea a few days before. The three ladies got safe to Sicily; but the king, after being some weeks at sea, was compelled by a storm to land on the coast of Istria, at a spot between the towns of Aquileia and Venice. After encountering many dangers he reached Erdburg, near Vienna, 21st December, 1192, where he fell into the power of Leopold, duke of Austria, an old crusader-enemy of the Holy Land, who transferred him to the custody of the Emperor Henry VI. He was now imprisoned closely in a castle in Tyrol. In this state he remained about three months. At length Longchamps, bishop of Ely, and chancellor, who had been intrusted with the government of England in conjunction with the Bishop of Durham, having discovered Richard's place of confinement, prevailed upon the emperor to allow the royal prisoner to be brought before the Diet at Ilagenau, 18th April, 1193. Here Richard defended himself with so much eloquence against several charges made against him, that Henry found himself compelled, by the general sentiment of the Diet, to enter upon negotiations for his ransom. Notwithstanding the insidious opposition both of his brother John and Philip of France, the royal captive was at last liberated, 4th February, 1194, after 70,000 marks had been actually paid to the emperor, and hostages given for the payment of 80,000 more. Richard arrived in England on 13th March, where his first care was to recapture the castles, &c., which had declared for his faithless brother John. He was again crowned at Winchester, 17th April; a ceremony which was considered necessary, most probably on account of his having while in Germany formally resigned his crown, and consented to hold it as a fief of the empire. On the 2nd of May following, Richard having, with his characteristic activity, employed almost every moment since his arrival in raising an army, again set sail from Portsmouth, his whole soul bent on chastising his brother

and the King of France. John soon submitted and made his peace. But the war, though it lasted till January, 1199, during which Richard was generally successful, was distinguished by few remarkable events. Hubert, archbishop of Canterbury, assisted by Longchamp, presided over the government at home with great ability. The large sums, however, which they were obliged to raise by taxation provoked much popular dissatisfaction; and the third year of the king's absence was distinguished by the remarkable national protest led by William Fitz-Osbert, styled Longbeard, the "advocate and king of the poor," as he was called. This extraordinary man was hanged at Smithfield, April, 1196, but was long venerated as a martyr. On 26th March, 1199, as Richard was engaged in reducing the castle of Chaluz, the stronghold of Vidomar, viscount of Limoges, who had refused to surrender a treasure found on his estate, to which the king laid claim in right of his feudal superiority, he was struck in the left shoulder by an arrow, of which wound he died.

Richard I. had no issue by his wife Berengaria, and was succeeded by his youngest brother John.

The character of Richard cannot be judged without reference to the general manners of the age in which he lived. His strength was prodigious, and his character fearless, passionate, and generous. His intellectual powers, both natural and acquired, were of a high order; and he was renowned in wit, in eloquence, and in song. A few of Richard's poetical compositions have been preserved. "La Tour Ténébreuse," 1705, contains a love-lay in Norman-French, and another chanson in mixed Romance and Provençal, said to be the joint composition of Richard and his favourite minstrel, Blondel de Nesle, and to be that by which Blondel, according to the well-known story, now proved to be a fiction of the thirteenth century, discovered his master's prison. *Cœur-de-Lion* was no unfavourable type of the splendid but useless feudal sovereign, and if he possessed many of the vices, exhibited most of the virtues, of chivalry. In 1884, in the Master of the Rolls Series, Mr. Howlett published the first really scholarly edition of William of Newburgh's "*Historia Rerum Anglicarum*," the chief contemporary writer of Richard I.'s time. His history reaches to 1198, and is most interesting and valuable.

RICHARD II. King of England, the only son of Edward the Black Prince and Joan the Fair Maid of Kent, was born at Bordeaux, 3rd April, 1366. He succeeded to the throne on the death of his grandfather on 28th June, 1377. The king being a minor, the powers of government were vested in twelve counsellors, who were appointed to assist, in other words to direct and control, the chancellor and treasurer. The first three years of this reign were filled with the war with France, and the real authority of the country was in the hands of the king's uncles, John of Gaunt, duke of Lancaster, and Thomas duke of Gloucester.

Meantime, in England the growing power of the House of Commons was especially asserting the right of taxation; while the labouring classes were agitating for some moderate amount of freedom. The explosion of these various elements was provoked by the pecuniary necessity to which the crown was reduced in the years 1379-80. To induce the Commons to grant the requisite supplies, it was found necessary, after a short struggle, to submit to their demands of not only being allowed to inspect the accounts of the royal treasury, but even to appoint the king's ministers. Then, in December, 1380, the famous capitation tax was imposed, which gave rise to the rebellion of Wat Tyler in the following summer. The career of this demagogue was suddenly terminated by the bold hand of Sir William Walworth, the lord mayor, who, when Tyler, coming forth from his men, rode up to a parley with the king in West Smithfield, plunged a dagger into his throat. In a few weeks the rising was completely suppressed in all parts of the kingdom. The victory was followed by numer-

ous executions on the scaffold, amounting, it is stated, to about 1500 persons—two priests, named Jack Straw and John Ball, and other leaders, being among the number. All the wealth of promises that had been made to the multitudes while they had arms in their hands were cynically broken. The young king behaved with great coolness and courage in a somewhat trying crisis.

On 14th January, 1382, Richard was married to Anne of Bohemia, daughter of Charles IV., the late emperor of Germany. In 1385 England engaged in hostilities with Scotland; and in the summer of that year Richard, for the first time, appeared at the head of his army. He was eagerly endeavouring to gain popularity and shake off the rule of his uncles. In February, 1388, met the "wonderful Parliament," as it was called, over which the king's uncle, Thomas duke of Gloucester, had so much influence that it banished the royal favourites De Vere, marquis of Dublin, and De la Pole, earl of Suffolk, and completely put down the king's party, the victorious "appellants" appointing a "committee of government." But at a great council held in May, 1389, Richard unexpectedly intimated that, being now in his twenty-second year, he intended to take the management of affairs into his own hands; and the suddenness of the movement secured its temporary success. Gloucester found it necessary to retire into the country, but was subsequently permitted to return. Gaunt was in Portugal. On the death of his queen in 1394, Richard solicited the hand of Isabella, a child of six, daughter of Charles VI. of France. After many delays, the treaty of marriage was finally arranged in October, 1396. The several small French wars of this reign were thus happily ended.

This French alliance is believed to have materially contributed to the domestic revolution that followed. In the beginning of July, 1397, the chief of the "appellant" lords, Gloucester, Warwick, and Arundel, were suddenly arrested by order of the king; and Gloucester was conducted a prisoner to Calais. A Parliament was then called, which condemned the three peers, and also Arundel's brother, the Archbishop of Canterbury, of high treason. The archbishop and Warwick were banished for life; Arundel was beheaded on Tower Hill; and when an order was sent to the governor of Calais Castle to bring up his prisoner Gloucester, the answer returned was that he had died, and few doubted that he had been made away with by the royal orders. The subservient Parliament, before it separated, devolved their whole power upon a commission of twelve peers and six commons, all devoted to the king; and having also obtained from them the grant of tonnage and poundage, which gave him a revenue for life, Richard might now be considered as almost an absolute sovereign.

This state of things, however, did not last long. Intoxicated by the success of his schemes, Richard set no bounds to his exactions and extravagance; and instead of being satisfied with the discomfiture of his enemies, devised means for ridding himself of others whom he still apprehended to be dangerous. The accusation brought by the Duke of Hereford against the Duke of Norfolk soon gave him an opportunity. The Duke of Hereford was Henry of Bolingbroke, son of John of Gaunt, and the king's cousin, one of the nearest claimants of the crown. Richard banished both accuser and traitor, an admirable piece of justice which he followed up by seizing the Lancaster estates in 1399 (February) at the death of John of Gaunt. This drove Hereford, now Duke of Lancaster, to desperation, and he set to work at once to gather troops and money to recover his inheritance. He landed in Yorkshire in July. Crowds flocked to his standard, for Richard's arbitrary rule had alienated all men. When Richard landed at Milford Haven, 5th August, 1399, from Ireland, where he had been putting down an insurrection, the greater part of the army deserted. He then disguised himself as a

Franciscan friar, and, accompanied by the Duke of Exeter and some more of his friends, fled to Conway. He surrendered to his cousin at Flint, and thence was carried to London, where he was lodged in the Tower. Here, 29th September, he consented to read a renunciation of the crown before a deputation of prelates, barons, knights, and lawyers. On the next day the two houses of Parliament met together in Westminster Hall, and voted his deposition, immediately after which the Duke of Lancaster was unanimously recognized as king. See HENRY IV.

Richard did not long survive his dethronement. In the following February rumours were spread that he was dead, and in the beginning of March his body, or what was declared to be such, was brought with funeral pomp from Pontefract Castle to London, and there exhibited openly to the people. It was reported by some that he had starved himself to death; by others that he had been starved by his keepers; by others that he had been violently made away with by Sir Piers Exton, assisted by other assassins. He is said to have been buried at King's Langley, on 14th February, 1400.

Of the alterations made in the statute law during the reign of Richard II., the most important was the extension of the former Acts against provisors, or persons obtaining papal presentations to benefices before they were vacant, by a series of new Acts, and especially by the 16 Rich. II. c. 5, commonly called the Statute of *Præmunire*. The right of impeachment and prosecution by the Commons in Parliament, which had been first asserted in the latter years of Edward III., was finally established in this reign by the impeachment of the Earl of Suffolk, the late chancellor, in 1386.

Richard II. had no issue by either of his wives (his second, indeed, was only a child of eleven years old at the time of his death). His character is an enigmatical compound of strength and weakness, courage and irresolution, indolence and energy. No part of English history is so ill-known as his reign, and it is quite possible that much of Richard's conduct may hereafter be explained. Of course his character is blackened because his history was written under the rule of his bitter enemy, Bolingbroke. On the favourable side we know that he was very tolerant, if nothing more, with Wyclif, and that he was a good friend to Chaucer. Such a man would, *prima facie*, seem not altogether a bad one; and certainly his attitude towards the religious reformers is in strong and favourable contrast with the cruelties of his successors.

RICHARD III. King of England, youngest son of Richard, duke of York [see EDWARD IV.], was born 2nd October, 1452, at Fotheringhay Castle in Northamptonshire. Soon after the accession of Edward IV. Richard was created Duke of Gloucester, made a Knight of the Garter, and appointed Lord High Admiral, though as yet only in his tenth year. When but a lad of nineteen, in 1471, he commanded the van of his brother's army at the battle of Barnet; and he assisted in gaining for Edward his next and crowning victory of Tewkesbury. He and his brother Clarence are asserted, without a jot of evidence, to have been the actual murderers of Henry VI.'s son, Prince Edward, after the battle. To Gloucester was ascribed also by popular rumour, again without any ground ascertainable, the murder of Henry himself in the Tower a few weeks after. The following year the Lady Anne Neville, daughter of the Earl of Warwick, and widow of Prince Edward, was prevailed upon to give him her hand. In 1482 he commanded an expedition to Scotland to aid the Duke of Albany against James III., and was still in command of his army on the borders when the death of his brother took place in April, 1483.

Gloucester hurried to London, seized the boy-king, Edward V., and called himself Lord Protector. He kept his residence at Crosby Place, Bishopsgate, in the city,

where he held frequent conferences with his confidants. All those whom he suspected of being unfriendly to him he caused to be arrested; and Lords Hastings, Rivers, and Grey, Sir Thomas Vaughan, and Sir Richard Hawes were executed on charges of treason. The Duke of Buckingham was his great adherent. It was he who, after the young princes had been denounced as illegitimate, caused the crown to be offered to Richard on 23rd June, 1483, which Richard accepted, after some feigned reluctance, in obedience, as he said, to the popular voice. Indeed the people were everywhere in his favour. While receiving congratulations in the north Richard received intelligence of the defection of Buckingham, and the organization of a formidable insurrection in favour of his two nephews; but on the death of the princes being rumoured the plans of the conspirators were changed, and the crown was offered to Henry, earl of Richmond, who, however, after having reached the coast of Devon, did not venture to disembark. Buckingham was deserted by his forces, and falling into the king's hands, had his head struck off in the market-place of Salisbury on 2nd November, 1483.

A Parliament was now summoned, which, having met on the 23rd of January, 1484, immediately passed an Act declaring Richard to be undoubted king of the realm of England "as well by right of consanguinity and inheritance as by lawful election, consecration, and coronation," and illegitimizing the issue of the late King Edward IV. by Elizabeth Rivers. This Act is known by the name of the "*Titulus Regius*," and is the earliest of what are called the Private Acts, none of which are given in any of the printed collections of the statutes. The "*Titulus Regius*," however, has been printed by Sir Robert Cotton in his "*Abridgment of the Rolls of Parliament*." Various Acts of public utility were also passed by this Parliament for the amendment of the criminal law and the regulation of commercial affairs, and the abolition of the arbitrary royal exactions known as *benevolences*.

Richard concluded a peace with Scotland in 1484, and soon after proposed to marry his niece Elizabeth (his first wife and only son having died) with a view of strengthening his title (1485). But the people were uneasy about the fate of the young princes, and the aspect of things was becoming more unsatisfactory every hour. At last, on 7th August, 1485, the Earl of Richmond landed at Milford Haven: and on the 22nd of the same month the battle of Bosworth deprived Richard at once of his crown and his life. Richmond succeeded him as Henry VII.

Both the character of Richard III. and many of the events of his reign have been subjects of dispute among modern writers, some of whom have gone the length of attempting to make out that most of the crimes imputed to him are the mere fabrications of his enemies.

For instance, it is abundantly proved that Richard was a strikingly handsome man, certainly no deformed, dwarfish, crook-backed, splay-footed, goggle-eyed, left-arm-withered monster from birth, as the malignant writers under Henry VII. were encouraged to make out. A great deal of evidence goes to show that he was of medium height and absolutely well formed, but on the other hand reliable witnesses charge him with one shoulder being higher than the other. Probably the truth was that this deformity was so slight as to need only an adjustment of dress to make it quite unnoticeable. His surname of *Crouchback* was altered, no doubt maliciously, to *Crook-back*. No hunchbacked dwarf with a withered arm could be dowered with Richard's great personal strength, known by many an anecdote. Next, as to his alleged crimes. The death of Clarence was the act of Edward IV. (and was not ill-deserved), not that of Richard. The death of his son and his wife are probably not due to him. The death of those who conspired against his rule is a matter of state policy in which Richard was not a whit worse than any

other monarch of his time. Finally, there is not a tittle of evidence showing that he was the murderer of Henry VI., nor of the princes, his own nephews, nor indeed of what was the fate of these latter. Tyrrel, said to have been knighted by Richard in reward of his murderous services, is now known to have received his dignity from Edward IV. Richard was a good son, a moral man as the times went, and certainly a very regular attendant on the services of the church. It must be remembered that he was but thirty-two when he fell, and he had managed to put some of our best laws upon the statute-book. As for his military capacity, it is to be noted that he was the only general able to tame Scotland between Edward I. and Cromwell; and at Bosworth, even with the treason of Stanley and a large part of his army, he almost succeeded in wrenching victory from his opponents against overwhelming odds. His statesmanship with every additional piece of evidence proves to be more and more in advance of the age. Moreover, his acts were endorsed by people and Parliament, and until the disappearance of the York princes he was very popular. He always professed he knew not what had become of them: he left them secure in the Tower, where they were not prisoners in the ordinary sense of the word (such was Richard's tale), but detained for their own security and the kingdom's peace, and they contrived to escape from their captivity.

It seems, so far as the evidence goes, that it was rather the nobles than the people who fell away from Richard. His measures in concert with Parliament were in refreshing contrast to the pure despotism of his brother Edward IV.; but while they pleased the people they of course displeased the nobles. Richard was brave, able, energetic, and an excellent commander; and was the only great noble unstained by bribery when France was invaded by Edward IV. On the other hand he was ambitious, and bloodshed did not afflict him when necessary. He was, in fact, a Plantagenet. Descended in no less than three lines from Edward III. (through Lionel, Edmund, and John of Gaunt), in two lines from Edward I., and in two lines again from Henry III., surely the family nature, passionate, brave, and capable, would be likely to be intensified in him. Of the three generations of ancestors preceding Richard no less than fourteen died by battle, murder, or the headsman's axe. Why should this man, in those times of disorder, be singled out for his violence and crime? When Hastings and Puckingham fell not one of their followers was harmed in either case. It is hardly consistent with a character such as Shakespeare and all the Tudor writers drew for Richard, that he should be a diligent protector of the church, of literature, and of commerce. However, this is not the proper place for a full discussion of the subject, nor for an attempt to extract the truth from the conflicting mass that represents the ordinary account of this king. The reader should consult the splendid works of original research of Mr. Gairdner, who devoted a quarter of a century to it. His "Life and Reign of Richard III." (1878); the appropriate parts of the famous "Paston Letters," edited by him in 1875; and "Letters and Papers illustrative of the reigns of Richard III. and Henry VII.," forming part of the magnificent Rolls Series, and published by Mr. Gairdner in 1861, are works which have elevated English historians by their accuracy and interest. A readable account of the case, with additional newly discovered matter, is also presented by Mr. Alfred O. Leege (London, two vols., 1885); but much yet remains to be cleared up. Horace Walpole's "Historic Doubts on Richard III." (1768) is of course merely suggestive, but it was very creditable at the time, and like everything else of the author's eminently readable. Jesse's "Life of Richard III." is also worth consulting.

RICHARD DE BURY (*Richard Aungerville*), the earliest of English bibliophiles, was born in 1287 in Bury

St. Edmunds. He was tutor to Prince Edward (afterwards Edward III.) He visited Rome twice, as legate to Pope John XXII., and on his return from his second mission he was made bishop of Durham by the king and the Pope. In 1334 he was made chancellor and high treasurer of England. It is said that he became possessed of more books than all the other bishops of England put together.

The best account of his researches and of his life will be found in the "Philobiblon," a curious and interesting Latin treatise written by himself, published at Cologne in 1473, English translation 1832. He died at Auckland on 14th April, 1345, and was buried in the Cathedral of Durham. He bequeathed his books to King's Hall, Oxford (now incorporated with Brasenose College), then called Durham College, thus founding the first public library in that university.

RICHARD OF CIRENCESTER, or *Ricardus Corinensis* (sometimes called the Monk of Westminster), a monkish historian of the fourteenth century, was so named from his being a native of Cirencester in Gloucestershire. He entered the Benedictine monastery of St. Peter, Westminster, in 1350, and appears to have died there in 1401. His chronicle, entitled "Speculum Historiale de gest. reg. Angust.," 447-1406, is in two parts, the first in the public library at Cambridge, the second in the library of the Royal Society. It is a mere compilation. But he is chiefly known from the celebrated forged treatise entitled "De Situ Britannia," which "lay hid in manuscript" till 1717, when it was discovered by Charles Julius Bertran, professor of the English language at the Royal Marine Academy at Copenhagen, who sent a transcript of the whole to Dr. Stukeley the antiquary, who published it. A translation may be found in Bohn's Antiquarian Library (1848). Dr. Stukeley was quite innocent in the matter. Gibbon and others were also deceived. Professor Mayer exposed the whole deception in his edition of the genuine "Speculum," &c. (two vols., Rolls Series, 1863-69).

RICHARD PLANTAGENET, Earl of Cornwall, and titular King of the Romans and Emperor of Germany, second son of John, king of England, was born on 5th January, 1208. He was created Earl of Cornwall by his brother, Henry III., in 1226. His election as King of the Romans, in 1256, he is believed to have owed entirely to his great wealth, which enabled him to bribe several of the electors. Richard was crowned at Aix-la-Chapelle, and occasionally exercised imperial rights, but he never enjoyed any real authority in Germany, nor indeed did he show himself much in that country. He was taken prisoner by De Montfort at the battle of Lewes in May, 1264, and was confined in Kenilworth Castle for more than a year. He died in his house at Berkhamstead on 2nd April, 1272.

RICHARDIA, the name of a genus of plants belonging to the order *AROIDACEÆ*. *Richardia africana* was introduced into this country from the Cape, under the name of *Calla Æthiopica*, in 1731. It is one of the most beautiful of aroidaceous plants. Its large spathe is pure white, surrounding a spadix, which is coloured deeply yellow by its antheriferous flowers. *Richardia* is a hardy plant, bearing well our mildest winters, and growing in great vigour and beauty in the ordinary apartments of a house. It may be made to blossom all the year round.

RICHARDS, BRINLEY, a Welsh musician, chiefly to be remembered as the composer of "God bless the Prince of Wales," was born in 1819 at Carmarthen, where his father was an organist. He left the study of medicine for that of music, worked at the Royal Academy of Music in London, became king's scholar there in 1835, and professor afterwards. He died in 1885. He was a good pianist and a successful writer of drawing-room pianoforte music. He had a fair knowledge of Welsh music, and sometimes lectured upon the subject. His "national

anthem" is not a very noble composition, but it is fairly tuneful, and was greedily welcomed by the public, both as an honour paid by a Welshman to his prince and also as being more appropriate than "God save the Queen," because a more personal welcome to the highly popular Albert Edward, Prince of Wales, when he began largely to represent the Queen, his mother, in public ceremonies.

RICHARDSON, SAMUEL, the father of modern novelists, was born in Derbyshire in 1689, and in his seventeenth year was bound apprentice to a London printer. He married his master's daughter, and succeeded his father-in-law in the business, at which he prospered, giving no sign till he was fifty years of age that he was ever to be more than a flourishing citizen of London. He was chosen master of the Stationers' Company, on which occasion one of his friends remarked that his abstemiousness ill fitted him for appearance at the civic feasts. He loved to encourage diligence and early rising among his journeymen, and often laid half-a-crown among the type, so that the first who came to work in the morning might find it. In 1540 some one suggested that his skill as a letter-writer was so great that he might well publish a volume of model letters—"A Complete Letter-writer." Richardson's reply was to astonish the world with "Pamela," a novel the story of which he carried on by letters, chiefly between Pamela and her father and mother. The heroine is a young girl, born of poor but pious parents, who is exposed to the solicitations of a libertine of rank, who afterwards offers her honourable marriage, and all ends happily. FIELDING satirized the weak points in this novel very skilfully in his "Joseph Andrews," where a virtue equal to Pamela's is displayed by her brother Joseph. The remarkable insight into female character shown by Richardson in this novel he had acquired as a youth by composing the love-letters of his girl friends. It is the first great English novel (unless we call "Robinson Crusoe" a novel), and it took the town by storm, was read not only for entertainment, but was recommended enthusiastically from the pulpit for its high moral tendency. Pope declared that it would do more good than many volumes of sermons. But "Clarissa Harlowe," published in 1748, is a much greater book than "Pamela," and it is upon it that Richardson's fame as a classical writer is based. Clarissa is a young lady pressed by her parents to marry a man in every way disagreeable to her, and, placed under the most cruel restraint, leaves her father's home, and throws herself upon the protection of her lover, who violates her person. Grief and shame overwhelm her, and she dies broken-hearted. Such is a brief outline of the story which has moved many generations of women to tears, which led Dr. Johnson to say that there was more of human nature in one page of Richardson than in all the novels of Fielding. The delineation of female character is indeed powerful and the pathos oftentimes effective, but undoubtedly Richardson ranks far below Fielding as a novelist. He has not the artistic power, the profound humour, nor the depth of insight of "the prose Homer of human nature." After the publication of two works, in each of which the principal character was a female, he determined to portray a perfect man, and produced in 1753 "Sir Charles Grandison," his last novel. Besides these three great works Richardson published a volume of "Familiar Letters on Various Circumstances of Life." The ninety-fifth paper of *The Rambler* was also written by him.

An interesting account is given in Sir George Trevelyan's "Life of Macaulay" of the distinguished historian receiving the eight volumes of "Clarissa" at a hillside station in India, devouring them for the twentieth time, lending them to the governor's wife, who lent them to the governor's secretary, and so on till, as the volumes passed from hand to hand, the whole station was kept in a ferment for some weeks over the trials and sorrows of the unfortunate heroine.

Richardson died of apoplexy, at the age of seventy-two, on the 4th July, 1761, and was buried in the middle aisle of St. Bride's Church, London. His correspondence was published, after his death, in six volumes.

RICHELIEU, ARMAND JEAN DU PLESSIS, CARDINAL DE, a younger son of François du Plessis, lord of Richelieu in Poitou, was born at Paris in 1585. He studied at the College of Navarre, and applied himself to the arts of war. The bishopric of Luçon was almost hereditary in the family, and was an appanage of the eldest son. When Alphonse, the eldest brother, resigned the bishopric, Armand swiftly qualified himself, and succeeded to the dignity in 1607, though only twenty-two. His military studies were, however, by no means wasted: they served him in good stead later on. In 1614 he sat as deputy of the clergy of Poitou in the assembly of the States general, on which occasion he harangued the young king, Louis XIII., and so pleased the queen-mother, Marie de Medicis, that she made him her almoner, which led to his being appointed secretary of state. When the king and his mother quarrelled, Richelieu acted as mediator, and acquired a permanent influence over both. In 1622 he was made a cardinal, and in 1624 the queen-mother obtained for him a seat in the council, when he became the chief minister of the crown, and continued to be so for the remainder of his life. Richelieu had three great objects in view: (1) to render the power of the crown absolute, and to humble the feudal nobility; (2) to annihilate the Calvinists as a political party; (3) to reduce the power of the house of Austria, and to extend that of France. Unscrupulous about the means he employed, he succeeded in breaking down the enormous power of the nobles, many of whom he sent to the scaffold on the slightest pretences. His words are famous: "I venture on nothing without first thinking it out; but once decided I go straight to my point, overthrow or cut down whatever stands in my way, and finally cover all with my cardinal's red robe." His great political opponent was Gaston d'Orléans, the king's brother, who on the failure of a conspiracy against the cardinal openly revolted against the king, but was at last obliged to seek an asylum in the Spanish Netherlands, while the Duke of Lorraine, who had assisted him, lost his dominions, which were seized by the French. The queen-mother, who had quarrelled with the cardinal on account of her Spanish-Austrian leanings, was also obliged to quit France in 1632. Later on, in 1642, another great conspiracy was aimed at the cardinal, under Cinq-Mars. He let it ripen as long as he pleased, and then with swift blows ruined all, and sent the chief to the scaffold. Popular superstition saw in the cardinal's death a few months later a judgment upon the ferocity of his revenge.

Richelieu accomplished his second object by besieging and taking La Rochelle, the stronghold of the Calvinists, in 1628. He, however, secured religious tolerance by a royal edict in 1629. In furtherance of his third great scheme, the cardinal, setting aside all clerical scruples, supported the Protestants of Germany against the emperor, fighting side by side with the Swedes of Gustavus Adolphus. His almoner, a Capuchin friar named Père Joseph, was his confidant and trusty agent in all his diplomatic intrigues. At the same time Richelieu was assisting the Protestant Grisons against the Roman Catholic insurgents of Valtellina, who were supported by the Spaniards. He also allied himself with the States-general of the Netherlands to attack the Spanish dominions in Belgium, which he had in view to annex to France as far as Antwerp, a project, however, in which he failed. On the side of Spain the French took Roussillon, and supported the Catalonians in their revolt against Philip IV. Richelieu is also said to have meddled, by means of Père Joseph and the French ambassador in London, in the first stirring of the Covenanters and Puritans which led to the Revolution in Eng-

land. In 1639 arms and ammunition were sent from France to Leith for the use of the disinclined. In Italy the French invaded Piedmont. The principal result of all these wars was to circumscribe the imperial power in Germany, and to weaken the influence of Spain in the general politics of Europe.

In December, 1642, Richelieu died at his house at Paris. His funeral was magnificent, but the people of Paris made bonfires in token of rejoicing. He had become unpopular in his later years on account of the burdens which he had laid upon them. His remains have recently been removed to a splendid mausoleum in the Church of the Sorbonne at Paris. Richelieu established the royal printing presses; he was the founder of the French Academy; he built the Palais Royal, which was then called Palais Cardinal, and he rebuilt the Sorbonne; he established the French Company of the Indies. In fact, in material administration the character of his policy enabled him to achieve many successes. That policy was unity, but the unity of centralization, not of common aims—a policy which, if not itself absolutely despotic, was scarcely distinguishable from it, and passed into uncontrolled despotism in the next reign. There is no denying that Richelieu made modern France; but he made her so that she has been often a curse to herself and to her neighbours also. He was a great man, but he worked on a low level, traded upon men's fears, gloried in the error he inspired, and surrounded himself with a crowd of base spies and intriguers, his mean ministers of vengeance. Yet Richelieu in himself was perhaps not so cold and ruthless as his unbending rules of policy made him in state affairs. He patronized literature and the arts, and maintained constant friendly relations with the best authors, among whom he loved to range himself, though what applause his mediocre plays and other works obtained was due only to flattery. However this may be, whether cruel and calculating by nature or by farsighted policy, Richelieu never deviated, as he says himself, from the courses he adopted from the first. Therefore while he did good in crushing out the turbulent independence of the nobles, he crushed out also the spirit of the *parlements*—those general convocations of lawyers which curiously enough preserved many liberties; and what was far worse, he silenced the States-general, reduced local liberties, assumed and maintained the right of arbitrary taxation by the king and his ministers, and of government by the unsupported royal edict; finally, he stifled every attempt at a free civic life wherever it appeared. The results of his work remain all too visible even now, after two and a half centuries have passed and many revolutions have occurred, for his acts were based upon a system, even though it was a wrong one, and struck deep root therefore into the kingdom he so ruinously built up. The rapid rise of France, the power and glory with which the national vanity was fed full through the successes of this man, who always knew what he aimed at, while his opponents were shiftless and distracted, concealed, and partly still conceal, the almost ineradicable mischief he was doing. With all his sacrifice of health and pleasure, and all his enormous and ceaseless labours, we can do no more than admire him, for we feel that they were rather offered on the shrine of an insatiate personal ambition than borne for the real good of his country or for the sake of his fellow-men.

RICHELIEU, LOUIS FRANÇOIS ARMAND DU PLESSIS, DUC DE, Marshal of France, was born 13th of March, 1585. He was the grand-nephew of the great cardinal. Gifted in intellect, brilliant in manner, and attractive in person, he had the questionable honour of being incarcerated in the Bastille at the age of fifteen, by desire of his father, who grew alarmed at his premature excesses. In 1716 he was again sent there by the Regent d'Orléans, whom he rivalled in profligacy; and in 1719 he was for the third time imprisoned there on a charge of conspiracy

with Spain. After various diplomatic appointments, which, curiously enough, he filled with conspicuous success, he distinguished himself by his bravery at the siege of Philippsburg, and afterwards at the battles of Dettingen and Fontenoy. His enormous and horrible profligacies, however, were such that not even his most brilliant military exploits could win him any real popularity. Nevertheless his services were great, especially in 1756, when he took Port Mahon from the English; and in 1757, when he drove the Duke of Cumberland from Hanover. For the rest of his life he was simply a courtier. Despite his vices he attained the age of ninety-two, dying 8th August, 1788.

RICHELIEU, ARMAND EMANUEL DU PLESSIS, DUC DE, French statesman, was born at Paris on 25th September, 1766. He was a grandson of the notorious marshal of the Regency. Flying to Vienna during the French Revolution, he there joined the Russian army of Sinwarow, and distinguished himself at the taking of Ismail from the Turks. Soon afterwards he was appointed a major-general in the Russian service, and he became lieutenant-general in 1801. He showed great energy and sagacity as governor of Odessa, a post which he held from the year 1803 (including the terribly trying time of the plague there) until the restoration of the Bourbons to the French throne (1815), after which event he was invested by Louis XVIII. with various high offices of state. After rendering many valuable services to his country during a time of great danger and distress, he finally retired from public life in 1818, and died at Paris in 1821.

RICHMOND, a market-town and municipal borough of England, in the county of, and 44 miles north-west from York, and 240 from London, having a station on the North-eastern Railway, is romantically situated on the summit of a rocky eminence, at whose base flows the rapid Swale. Across the river is thrown a modern bridge of three arches, which leads to the railway station. The castle crowns the summit of a rock which overhangs a bend of the Swale, its stern, gray, and massive keep towering above a mass of inferior buildings. It was founded by Alan the Red, first earl of Richmond, immediately after the Conquest, but the keep was erected by the fifth earl, who was also Duke of Brittany. It is 100 feet high, and the exterior walls are 11 feet thick. The view from the battlements is one of the very finest in England. "On one side the eye ranges up the wide hollow of Swaledale, and on the other over the fertile plain of Mowbray, to the distant towers of York and to the estuary of the Tics. Far below the river foams and dashes over its rocky bed, through a grand broken foreground, with trees and hanging banks." Robin Hood's Tower, the Chapel of St. Nicholas, and the Castle Court present many points of interest. The parish church was restored and rebuilt in 1860. The choir and tower are Perpendicular, the rest Decorated. The grammar-school was founded by Queen Elizabeth, but the school-house dates only from 1850. Of the old Franciscan priory only a Perpendicular tower remains. The town, which is neatly built and enjoys a healthy air, contains a fine Roman Catholic chapel, built in 1867, and several other denominational chapels and charitable institutions. The municipal borough is governed by four aldermen (one of whom is mayor) and twelve councillors; population in 1881, 4502. Richmond is the seat of the ancient "Honour" of that name, and the capital of old Richmondshire. The borough returned a member to Parliament until 1885, when it was merged in the county.

RICHMOND, a town of England, in the county of Surrey, on the South-western Railway, about 8 miles from London by road and 10 miles by rail. It is picturesquely situated on the slope and crest of a gentle eminence on the eastern bank of the Thames, with the rich masses of foliage of Richmond Park gathered in the background. The neighbourhood contains numerous palatial mansions, situ-

ated in their own beautifully ordered grounds. The view from the terrace on the top of the hill is one of the finest of its kind in the world, embracing a vast extent of undulating country, studded with towns and villages and towers, and crunched by the silvery windings of the Thames. It has been celebrated by the poet Thomson in some well-known lines:—

"Heavens! what a goodly prospect spreads around,
Of hills, and dales, and woods, and lawns, and spires,
And glittering towns, and gilded streams, till all
The stately landscape into smoke decays."

The original name of Richmond was Sheen, from the Saxon *schene*, bright. The Old English kings had a palace here, and it was the residence for a time of Edward I. Edward III. died beneath its roof, 21st June, 1377; and Anne of Bohemia, queen of Richard II., in 1394. It was rebuilt by Henry V., but accidentally destroyed by fire in 1499. Henry VII. rebuilt it with great splendour, and died here in 1509. Charles V. was lodged in it on his visit to Henry VIII. in 1523. It was the frequent residence and the death-place of Queen Elizabeth. During the Civil Wars it was greatly injured, and after the Restoration it fell into decay, and though so rich in historical reminiscences was finally pulled down. Its only relic is the entrance gallery of the Wardrobe Court (now Old Palace Yard). Of the three monastic institutions of Richmond not a vestige remains. Richmond Park, nearly 9 miles in circuit, and covering about 2300 acres, is a fair expanse of hill and dale, planted with noble trees, and graced with large herds of deer. It contains some exquisite "bits" of sylvan scenery, and is always open to the public. There are two large sheets of water, comprising 17 acres. What is called the Old Park extends along the Thames from Kew to Richmond. A handsome stone bridge, built in 1777, crosses the river to Twickenham. James Thomson, the poet of "The Seasons," lived and died at Rosedale House. He is buried in the old church, a plain building of brick, with a stone tower, dating from 1339. Here also are interred Gilbert Wakefield, the philanthropist; Edmund Keau, the tragedian; Mrs. Holland, the novelist; and Dr. Moore, the author of "Zeluco," and father of the hero of Corunna. A Decorated church was built in 1858, to the west of the far-famed hill. Its lofty spire—190 feet high—is a conspicuous landmark to all the country round. Another church was erected in 1870. St. John's Chapel was erected in 1831. Bishop Duppa's almshouses were founded in 1661, for ten poor spinsters above the age of fifty; Hickley's in 1729, for six men and ten women. Ham House, the seat of the Earl of Dysart—a stately Jacobean mansion, raised by Sir Thomas Vavasor in 1610—is near Richmond. It was the seat of Charles II.'s Duke of Lauderdale, the L of the C.A.B.A.L., so graphically portrayed in Scott's "Old Mortality." It contains a noble carved oak staircase, picture closet, tapestry room, the cabal chamber, and a fine library. Here was born the second Duke of Argyll. Richmond had a population of 19,066 in 1881.

RICHMOND, an electoral division and province of Cape Colony, between those of Hope Town (north), Graaf Reynet (south and east), and Victoria (west). It has an area of 4463 square miles, and is situated on the cool upland region behind the Sneeuwbergen, called the Winterveld. It is entirely a pastoral country. Richmond, the chief village, is situated 450 miles from Cape Town, and 245 from Port-Elizabeth.

RICHMOND, a river-port and the state capital of Virginia, one of the United States of North America, is situated on the James River, at its lowest falls, 150 miles above its mouth, and on the Richmond and Aquia creek. There are three bridges across the river, connecting the city with Manchester and Spring Hill, on the opposite side. Richmond is the centre of numerous railways. During the American Civil War it was chosen as the headquarters

of the Confederate States. The population in 1880 was 63,600. The city is regularly laid out, and is surrounded with beautiful scenery. There are numerous churches. The other principal buildings are the capitol, with by far the best statue of Washington in existence, situated in a spacious square on an eminence overlooking the river, from which the view is superb; several colleges, a custom-house, county court-house, state penitentiary, city gaol, Virginian armoury, orphan asylum, theatre, museum, masonic hall, St. Vincent's Roman Catholic College, and various public libraries and schools. The city is well furnished with water from the river. The principal manufactures carried on are of machinery, cotton stuffs, tobacco, and paper; there are also some saw mills, a cannon foundry, various forges, and corn mills. The chief exports are wheat, flour, hemp, and tobacco—Richmond being the depot for the famous tobacco product of Virginia. Vessels drawing 14 feet of water come up to the "Rockets," a mile below the city; and by the aid of a canal the river above it is navigable for boats for 220 miles.

The city was founded in 1742, and was the scene of a most protracted siege during the American Civil War, when it was encircled by General Lee with formidable lines of fortifications. It was ultimately entered by the Federals, under Generals Grant and Sherman, 3rd April, 1865, but a considerable portion of it was destroyed by the retreating army. Its capture may be said to have ended the war.

RICHTER, ERNST FRIEDRICH EDWARD, an eminent theoretical musician who has done much to form the present high standard of correctness in musical writing, was born at Grossschönau, Saxony, in 1808. He was appointed professor of harmony and counterpoint by Mendelssohn at the Leipzig Conservatorium, and in 1868 succeeded Hauptman as cantor of the Thomas Schule (Bach's honoured post). His treatises on harmony, counterpoint, and fugue are as widely read in the English translation as in the original. Richter died in 1879.

RICHTER, JEAN PAUL FRIEDRICH, a distinguished German novelist, principally known to English readers by Carlyle's criticisms and translations, was born on the 21st of March, 1763, at Wunsiedel, in the Fichtelgebirge in Bavaria, where his father was schoolmaster and organist. Of this parent, who afterwards became pastor, first at Joditz, then at Schwarzenbach, Richter was able to say, "When I think that I never saw in my father a trace of selfishness I thank God." In his mother he was equally blessed. "Unhappy is the man," he says, "for whom his mother has not made all other mothers venerable!" Early sent to Leipzig University to study for the church, he devoted himself to a literature written by clergymen it is true, but not the most clerical, and read with delight the writings of Swift and Sterne in the original. He published, in 1783, two satirical works, "Greenland Lawsuits" (*Grönländische Prozessen*) and "Praise of Stupidity" (*Lob der Dummheit*). No success attended these juvenile efforts, and his mother having become a widow, and scarcely able to maintain herself and family, Richter went to live with her at Hof. The picture we have of him at his literary avocations in the one-roomed house, surrounded by mother and brothers engaged in their various occupations, is very pathetic. There are few scenes in the history of the calamities of authors more sad and yet more strengthening than the manly self-control with which Richter met the adverse circumstances of these early years at Leipzig and Hof. "A prisoner's allowance is bread and water, but I often had only the latter," he afterwards wrote. Perhaps the unhappiest time of his life was his three years' tutorship at Tüpen (1786-89), but with the opening of a school at Schwarzenbach, in 1790, and his friendship with Christian Otto, a brighter life dawned for him. An essay on "Death," which he sent to Herder, won him the friendship of that dis-

tinguished man. The publication of his novel, "The Invisible Lodge" (*Die unsichtbare Loge*), in 1791, made him famous throughout Germany, and brought some slight honorarium into his empty treasury. It is touching to read of the poor, but at length successful, author walking late one night from Schwarzenbuch to Hof to pour the ducats he had received for "The Invisible Lodge" into the lap of his astonished mother. With the publication of "Hesperus" (1794), Richter became the idol of the women of Germany, as Rousseau by his "Emile" had won the hearts of the women of France. Ladies of rank sent him letters, presents, and in two cases offers of marriage.

"Quintus Fixlein" (1796), an idyll of a schoolmaster's life, and "Flower, Fruit, and Thorn Pieces" (*Blumen-, Frucht-, und Dornenstücke*, 1796) were followed by a visit to Weimar, when Goethe received him coldly, Schiller more kindly, and Herder and Wieland with enthusiasm. Wieland having read "Tristram Shandy" through eighty times, was not likely to be indifferent to such a humorist as Richter. "Titan" (1802), "Introduction to Aesthetics" (*Vorschule der Aesthetik*, 1804), "Levana," a treatise on education (1805), "Flower-Jahre," which Carlyle translates "Wild Oats," which should apparently be more properly translated "Apprenticeship" (1805), "The Life of Fabel" (*Leben Fabels*, 1812), and "Nicolas Margrat" (1820) complete the list of his more important works.

After varied love experiences, arising out of the hero-worship inspired by his works, he married in 1801 Catherine Mayer, with whom he lived very happily. She once wrote to her father, "Thank God. I have a husband with whom love in married life can only take the path of honour and morality, one that I must obey as we obey virtue itself. And this man so loves me that I have nothing to wish for but that we may die together." Richter received many compensations in later life for the struggles of his early years. Pensioned by the Bavarian government, he died at Baireuth on the 14th November, 1825. His autobiography, "Wahrheit aus Jean Paul's Leben," was published after his death, with additions by his friend Otto.

Richter, who called himself, and is invariably called, "Jean Paul," is the one great German humorist. Goethe and Schiller had no humour, nor had Lessing, and the sparkling wit of Heine is far removed from this great gift which Richter shares with so many eminent English and French writers. Richter has been compared with Carlyle, but they have little in common. Carlyle's humour is sometimes coarse and often harsh. The delicacy and kindness of Richter are perhaps the chief sources of his influence over women. Carlyle borrowed many of Richter's eccentricities of language, and whole pages of "Sartor Resartus" might have been written by the German humorist, but the marvellous gift of historical portraiture which is, perhaps, the most undying glory of Carlyle, was beyond his range; and to the mastery of detail and concentrated vigour of the "French Revolution," "Cromwell," and "Frederick II.," Richter never attained. He has the genial humour of Lamb, the discursiveness of Coleridge, and the prolixity of Richardson. A life, however, of such high ideals and errorless purpose has lessons even greater than the romances which brought him fame. "What is poverty," he says, "that a man should whine under it? It is but like the pain of piercing the ear of a maiden. And you hang precious jewels in the wound."

Richter's works were collected after his death by his son-in-law, Otto Spazier, who added a valuable biographical commentary. A cheap edition ("Jean Paul's Sämmtliche Werke") is published at Leipzig in thirty-four volumes. Lives have been published in German by Doering, Förster, and Eckardt, and in English by Lee; also his correspondence with Herder and Voss. In England we have translations of "Levana" and "Flower, Fruit, and Thorn Pieces" in Bohn's Library, and of the latter work in

the Tauchnitz edition. "The Death of an Angel" has been translated by Henry Morley, also by R. Holcroft; "Titan" and "Hesperus" by C. T. Brooks, and published at Boston, United States. Carlyle translated "Quintus Fixlein," "Schmelze's Journey to Flætz," and "A Review of Madame de Staël's *Allemagne*," and wrote two beautiful essays republished in his "Miscellanies." A dictionary to Richter's writings, "Wörterbuch zu Jean Paul's Schriften," by Carl Reinhold, was produced at Leipzig in 1809.

RICIMER, a Gothic chieftain brought up at the court of Valentinian, emperor of the West, early obtained military distinction, and rose to the dignity of count of the empire. Having defeated an invasion of Italy by the Vandals, he turned against and crushed the titular emperor, Avitus. He now became so powerful as to be able to nominate at his pleasure the Emperor of the West. His own barbarian origin rendered him averse to assume the imperial title, but he was careful to retain in his hands the substance of power. Through his influence Majorian was made emperor in 457, but becoming an obstacle to his plans, was put to death in 461. Libius Severus, and afterwards Anthemius, whose daughter Ricimer married, filled for brief spaces the throne. In 472 Ricimer quarrelled with Anthemius, marched upon Rome and took it by assault, the emperor perishing in the battle. Ricimer now made Olybrius emperor. He died in the same year of a fever, having made and unmade five Roman emperors.

RICINOLEIC ACID is a fatty acid found in castor-oil, *Ricinus communis*, natural order Euphorbiaceæ. It is a pale yellow oily acid, having a specific gravity of 0.94. It is soluble in alcohol and ether; the formula is $C_{18}H_{34}O_2$. It is inodorous, but has a very disagreeable taste. The castor-oil of commerce consists mainly of this fatty acid combined with glycerin. It forms a number of salts called ricinoleates, the general formula of which is $C_{18}H_{32}MO_2$. It also forms an ether called ricinoleate of ethyl ($C_{20}H_{38}O_3$), which is a yellowish oil that is decomposed by heat.

When castor-oil is treated with ammonia-alcohol for some time, ricinoleamide ($C_{18}H_{36}NO_2$) crystallizes out in white needles. It melts at 66° C. (150° Fahr.). It is soluble in alcohol and ether, and is decomposed by acids and alkalis, forming ammonia and ricinoleic acid.

RICINUS is a genus of plants belonging to the order EUPHORBACEÆ. The seeds of *Ricinus communis* yield **CASTOR-OIL**. In our climate this plant is merely an annual herb, only growing to the height of 4 or 5 feet, but in tropical countries it is said to form a tree of 40 feet in height.

The characteristics of the genus are as follows:—Flowers monœcious; calyx with three to five divisions; no petals; stamens numerous, branched; style with three branches; ovary three celled with a single pendulous ovule in each cell; fruit capsular, breaking up into three valves. See **PLATE**.

RICKETS (from Anglo-Saxon *ricg*, the back), or *Rachitis* (from Gr. *rhachis*, the spine), a disease very common in London and other large towns in England, of which the principal features are a peculiar softness of the bones and a general muscular and constitutional weakness. It is exclusively limited to young persons, and in the great majority of cases the symptoms appear during the completion of the first dentition, or before the end of the second year. It is not an hereditary disease in the usual acceptance of that term, for persons of healthy constitutions may have rickety children, and parents who have been rickety do not seem liable to transmit the disease, but when a mother suffers from poorness of the blood, is in a state of general debility during pregnancy, or has had children in too rapid succession, there is always a danger of the children being born rickety. The disease is most common among the poor, the later born children being the chief sufferers, owing to the struggle for existence being rendered more severe by

the increasing size of the family; but it is not inevitably linked with poverty, for in a mild form it is occasionally encountered among persons in easy circumstances. It is believed that among the single causes which help to produce rickets the practice of over-suckling is the most powerful, and it has been observed that children kept too long at the breast frequently become rickety even though fed at the same time upon other and suitable food. The impairment of the mother's health occasioned by this practice is also very frequently the cause of the subsequent pregnancy resulting in the birth of a child which becomes a victim to this disease. It is a common experience also that when one child is born which becomes rickety the succeeding offspring are affected in a similar manner. The causes subsequent to birth which help to bring about this disease are chiefly bad feeding, foul air, damp cold rooms, want of sunshine, confinement within doors, and want of cleanliness, the first two of these having the most direct and powerful influence. An acute disease during the first few months of life, or an unusually prolonged and painful dentition, may also be regarded as predisposing causes of the disorder. The symptoms of rickets are never observed at birth, and most commonly the condition is not noticed until the first dentition commences, or the child attempts to walk. The first symptoms observed are usually those which indicate irritation of the intestinal canal; there may be diarrhoea alternately with constipation, loss of appetite, enlargement of the belly, and more or less emaciation. The child is dull and languid, or peevish and fretful, is restless and uneasy at night, and its motions have a peculiarly offensive rotten odour, owing to the decomposition of undigested food in the intestines. Another sign is a profuse sweating of the head, face, and neck, which is especially seen when the child falls asleep either at night or in the day. The warmth of the bedclothes is unpleasant, and the child kicks them off persistently even in the winter, but in spite of this it will perspire sufficiently to make its nightgown and pillow quite wet. Later on it is observed that the child dreads to be touched or played with, and that it will cry with pain if danced about. Very shortly afterwards the characteristic deformities of the disease make their appearance. These are first indicated by an enlargement of the ends of the long bones, the flat bones becoming thicker, and all of them losing their firmness and growing softer. An inspection of the wrists and ankles reveals the fact that the joints are enlarged, the ends of the ribs where they join the breastbone are also larger than usual, the edges of the bones of the skull are unusually prominent, and the anterior fontanelle or opening between the bones on the crown of the head remains open long after the period at which it closes in healthy children. Owing to the softness of the bones the weight of the body causes them to become bent and twisted, the direction of the bending depending upon the direction in which the force of pressure is applied. Thus the arms and forearms are bent outwards, while the thigh-bones bend forwards, and the bones of the legs bend outwards, producing the condition known as "bandy legs." The spine is curved forwards on account of muscular and ligamentous weakness, but it is a characteristic feature of this disease that the spinal curvature disappears when the child is lifted by the shoulders. The deformity of the chest is that termed "pigeon breast," the bending of the ribs forcing the breastbone forward in a manner not unlike the breast of a bird. The face, owing to the arrest of the growth of the facial bones, appears small in proportion to the skull, more especially as the forehead is usually high and square, and sometimes prominent. The process of teething is generally delayed, and the teeth that come are deficient in enamel, and decay rapidly. Sometimes, too, the bones of the pelvis are distorted, the pelvic cavity being greatly narrowed, a circumstance of serious import if the child be a girl, and one that

may greatly interfere with child-bearing at a later period, even to the endangering of life.

Rickety children, owing to their inability to join in infantile sports, are usually much in the society of their elders, by which means they pick up ideas and phrases in advance of their years, and come to be regarded as unusually precocious, but as a matter of fact they are often as backward in mental development as in physical strength. Another characteristic of the disease is an intense susceptibility to cold, with great weakness to the respiratory organs, and it is to chills in different forms that most of the deaths occurring in this disease must be attributed. Death may also occur from diarrhoea, and rickety children are especially liable to attacks of spasmodic croup (*Laryngismus stridulus*) and convulsions. The disease by itself is not a common cause of death, but the condition always largely increases the danger from other diseases.

The foregoing description must be taken as applying to the fully developed form of the disease, but it occurs with many variations, and the more prominent symptoms arise from general debility, attended by weak ankles, knock-knees, round shoulders, &c., up to a condition of absolute helplessness, followed by hump-back and other kinds of extreme deformity.

With respect to the prevention of this disease, the first care must be for the health of the mother during pregnancy, and the second to secure proper nutrition for the child from the birth onwards. The latter condition is most essential, and both for preventive and curative measures a digestible and nutritious diet is of primary importance. In the earliest stages of life abundance of good milk is the first requisite; at the later stages some variety in the food becomes requisite. When the symptoms of rickets are observed after dentition has commenced, in addition to milk, to which a little lime-water may be added with advantage, the child should take beef-teen, broth, bread and butter, the yolk of an egg beaten up with milk, milk puddings, &c. After the first year strong beef-gravy may be added to the diet, and at sixteen or eighteen months a little meat may be given. Some practitioners advise that the meat should be finely minced or pounded in a warm mortar, while others recommend that it should be given to the child in such pieces as will necessitate chewing; the particular circumstances of each case will indicate which is the better method. Besides attention to diet it is necessary that other hygienic conditions be secured, and the child when indoors should be kept in well-ventilated rooms; it should be warmly dressed, kept perfectly clean, and taken out regularly into the open air. Next to good and wholesome food, fresh air is of the greatest importance. Of the drugs used in the treatment of this disease castor-oil, rhubarb mixed with carbonate of soda, or Gregory's powder are useful in correcting the action of the bowels. For tonic and strengthening purposes reliance must be placed upon cod-liver oil and iron. Cod-liver oil should be given from the outset, and its use should be steadily persisted in throughout the whole period of treatment. The quantity administered must be regulated according to the patient's powers of digestion, a teaspoonful twice a day being generally quite sufficient. Iron may be taken in the form of reduced iron citrate, or in connection with other remedies, as in Parrish's food. A very good form also is that of steel wine, and when this is used the two remedies may be given together. For this purpose a teaspoonful of the steel wine should be put into a wine glass, and sweetened with a lump of sugar, and then the glass being half filled with water the oil may be floated upon the top. About an hour after a meal is the best time to administer cod-liver oil or iron, or the combination, these drugs being more easily retained by a full than by an empty stomach.

The bone deformities are best prevented by hindering the child from walking while the bones are still soft, and when

the limbs have begun to bow the pressure of light, well-padded, and well-banded splints projecting beyond the feet will be very useful for reducing the deformity. When the bones of the trunk are implicated the child should be encouraged to keep the horizontal position. Sea-water bathing, where it can be borne, is often of great service, and the same may be said of friction with the hand applied to the back and limbs for about half-an-hour morning and evening. Happily in the general way much may be done by care and medicine towards the cure of this disease, and many cases recover, the children growing up to adult life with a fair measure of health and strength. It must always be remembered, however, that owing to the nature of the complaint a rapid recovery cannot be looked for, and long-continued care and persistence in the use of remedial measures are absolutely necessary for recovery from this disease.

RICKMAN, THOMAS, was born at Maidenhead, on 8th June, 1776, and brought up by his father, who was a surgeon and apothecary in that town, to the same profession. He was brought up a member of the Society of Friends. He went to London in 1797, and obtained some employment as a chemist's assistant; but he abandoned the calling, and held situations subsequently, both in London and in the country, with a grocer, a cornfactor, and an insurance broker. An innate taste led him to the study of architecture, and he contrived, unaided by any person, to gain considerable knowledge of Gothic styles, then almost entirely disregarded.

On the grant of £1,000,000 for additional churches being made by Parliament, Rickman became a competitor; and a design sent in by him being accepted, he determined to establish himself as an architect at Birmingham. He continued to exercise his profession up to the time of his death, 4th March, 1811. His best work is the new quadrangle of St. John's College, Cambridge, which certainly has very fine points. As a rule Rickman was but a tame and "correct" imitator.

Rickman's "Attempt to discriminate the Styles of Architecture in England" would have obtained for him celebrity, for it has become a standard book, and one still most valuable to the student. He was the first to recognize and distinguish the characteristics of the different periods of Gothic architecture, and he gave them the names—Norman, Early English, Decorated, and Perpendicular—which they still retain.

RICKMANSWORTH, a small town of England, in the county of Hertford, is 21 miles from London by the North-western Railway, and about 27 from Hertford. The town is irregularly laid out, but is very pleasantly situated and unusually healthy. It is a very favourite resort of anglers. The church was rebuilt some years ago. There are Baptist and Wesleyan chapels, the latter a very handsome building. A small Gothic town-hall was built in 1870. On various streams in and near the town are silk, paper, and flour mills, and some straw-plaiting and horse-hair weaving is carried on. The Grand Junction Canal passes through the town. Near Rickmansworth is Moor Park, which was the residence of Cardinal Wolsey, of the unfortunate James, duke of Monmouth, and of Lord Anson. Grove Park and other seats are also in the immediate neighbourhood. The population of the parish in 1881 was 5511.

RICOCHET, a word expressing the act of rebounding, is applied in artillery practice to the action of a shot or shell which, having described a curve in the air, descends to the ground, and after striking rebounds from thence, several descents and subsequent rebounds frequently taking place before the force of impulse is destroyed.

Before the introduction of rifled ordnance and elongated projectiles ricochet firing was largely employed in the attack of fortresses in order to enfilade or rake the faces of

works whose fire might be directed upon the ground on which the approaches were to be made. It was first reduced to method by Vauban at the sieges of Philippsburg and Mannheim, in the war of 1688; and on these occasions, as well as at the siege of Ath, which was conducted by Vauban during the same war, the surrender of the places was greatly accelerated by it.

RIDDLE (Ger. *Rätsel*), a *jeu d'esprit*, a play upon words, designed by a studied obscurity to stimulate the curiosity and puzzle the judgment. In its present form it is only used as a verbal pastime, and appears in the various shapes of the conundrum, enigma, and charade; but in ancient times it was frequently employed as a vehicle for some important truth, and the greatest philosophers did not disdain to engage in its composition. The riddle is found in the Old Testament, was known to the Egyptians, and conveyed the mysterious utterances of the Greek and Roman oracles. The riddle of the Sphinx enjoys a world-wide celebrity. One of the oldest collections of the humorous riddle is the "Demands Joyous," printed in English by Wynkyn de Worde in 1511.

RIDING (from the Saxon *trithing*, or third part), a term applied to the three divisions of Yorkshire, called respectively the East, West, and North Ridings. It originated in the Anglo-Saxon administration, and is identical with the "lath" or "rape."

RIDLEY, NICHOLAS, the Protestant martyr-bishop, was born in Northumberland near the birthplace of the sixteenth century. He was educated at Newenham, and at Pembroke College, Cambridge. He received further instruction in France, returned to Cambridge, took orders, and became master of his college, one of the king's chaplains, and in 1547 Bishop of Rochester. His denunciations of the use of images and of holy water soon showed him the strenuous supporter of Protestant doctrines, and his abilities caused him to be associated with the principal reformers both in their chief undertakings and discussions. After Bonner had been deprived of his dignities, Ridley was appointed his successor in the see of London. In his diocese he actively endeavoured to diffuse Protestant doctrines, for the better understanding of which he assisted Crammer in framing forty-one articles, which were subsequently promulgated. He was nominated Bishop of Durham, but this appointment was never completed. He exercised great influence over Edward VI., and induced him to found St. Bartholomew's Hospital and other important charities.

On Mary's accession Ridley was imprisoned, notwithstanding that he had previously interceded with King Edward to allow her the free exercise of her religion. The detestation of his opinions was aggravated both by the services he had rendered to the Protestant cause and his opposition to her accession. In April, 1554, a convocation was appointed at Oxford, at which the doctrine of the "real presence" was to be discussed, and Crammer, Ridley, and Latimer were sent there as prisoners. Each disputed in his turn amidst great disorder, shoutings, tauntings, and reproaches. All were considered to be defeated, and all were adjudged obstinate heretics. Ridley never again left Oxford. After resisting many efforts to induce him to recant, he was led to the stake with Latimer on 16th October, 1555. The place of his execution was in front of Balliol College. Burnet says that for his piety, learning, and solid judgment, he was the ablest man of all that advanced the Reformation; and Foxe truly says of him:—"Wise was he of counsell, deepe of w't, and very polite in all his doings. . . . In all points so good, godlie, and ghostlie a man that England may justly rue the loss of so worthe a treasure."

RIENZI, COLA DI, whose real name was *Nicola Gabrino Lorenzo*, one of the most illustrious of Italian patriots, was born at Rome in or about 1310. He was the

son of a water-carrier, whom tradition alleges to have been one of the illegitimate offspring of the Emperor of Germany, Henry VII. His mother was a Roman woman of humble condition. He contrived, however, to secure an excellent education, and his mind was of that quick and comprehensive order which profits quickly by careful culture. The pages of the classic writers fired his ardent imagination. In the brilliant records of Livy and Tacitus and Sallust he found a magnificent picture of olden Rome—as she was under the Consulate and the Caesars. Naturally of a vivid and penetrating intellect, he compared this gorgeous presentment of pomp and imperial sway with the Rome around him—the city of ruined monuments and shattered palaces, which strikingly illustrated its past splendour and present desolation. He saw his fellow-citizens oppressed by the patricians, despoiled by hordes of robbers, and even deprived of that protection which the presence of the papal court had formerly afforded—Clement V., a Frenchman, preferring the luxurious indolence of Avignon to the storms and dissensions of Rome.

The Rome of Rienzi's youth was, in truth, a dungeon and a shambles. All kinds of lewdness, all forms of evil prevailed; there was no justice, and there was no authority. Ruin fell upon every one, and as law was never recognized, it was vain to seek redress. A younger brother of the aspiring scholar was slain in a street brawl. He demanded the punishment of the murderer, but was met with contemptuous indifference. His private sorrows thus came to aid and influence his indignation of the public woes, and deepened his reverence for the glorious days of old. He longed to avenge his brother's blood; he longed to restore the imperial state of Rome. His eloquence, his popular sympathies, his commanding genius, his handsome person, had already gained him a great influence over the multitude. He now began to organize an insurrection, and secretly countenanced by the papal officials, resolved to overthrow the authority of the patricians. He gathered around him a band of devoted adherents; he convoked a species of representative assembly; he instituted courts of justice, and organized a system of military police, which drove brigandage and rapine out of the Roman states. Elected tribune of Rome, he assumed a more than regal pomp, knowing well the influence of the paraphernalia of power upon the impressionable children of the south. Then he compelled the Roman nobles to swear they would recognize the new order of things, the *buono stato* or good state of Rome, as he was pleased to designate the liberal despotism which he had established.

This remarkable event took place on the 20th of May, 1317. Rienzi had passed the previous night in solemn religious observances. At midnight the trumpets rang through the Roman streets, and all brave citizens were summoned by Cola di Rienzi to meet him at the Church of San Angelo. He appeared there in full armour, accompanied by the Pope's legate, and attended by bands of youths bearing banners and waving laurel boughs. In an oration of matchless fervour he addressed the excited assemblage, reminding them of the past glories of Rome, and undertaking to restore them. Absolute authority was solemnly placed in his hands, and he was named Tribune of Rome. A wonderful change was speedily effected by the stern impartial rule of this great man, who blenched not through fear of patrician anger or plebeian fickleness. Never, perhaps, was the influence of one energetic mind more vividly exhibited. A den of robbers was transformed into a peaceful and prosperous city. "In this time," says the historian, "did the woods begin to rejoice that they were no longer infested with robbers; the oxen began to plough; the pilgrims visited the sanctuaries; the roads and inns were replenished with travellers; trade, plenty, and fair dealing were restored in the markets; and a purse of gold

might be exposed without danger in the midst of the highways."

But the possession of uncontrolled power intoxicates an enthusiastic nature. Rienzi had in him too much of the poet to make a safe ruler. His imaginative and his dramatic bias led him into fantastic excesses, while the sober work of organization and consolidation was gradually neglected.

There is still preserved in the baptistery of the Church of St. John Lateran a vase or bath of green basalt, in which, it is said, the great Constantine received the rite of baptism on his public profession of Christianity. On the night of the 1st of August, 1317, previous to his receiving the insignia of knighthood, Rienzi bathed in this vessel, which was an object of peculiar sanctity in the eyes of the common people. And on the following day, before a vast multitude, he delivered an extraordinary harangue, pronouncing every state and city in Italy free; proclaiming Rome the capital of the world; and citing Clement VI. and the princes of Germany to appear before him. Indenting with his sword the four points of the compass, he exclaimed, "And this, and this, and this is mine; to me it belongs to judge the earth with justice, and the nations with equity." Then he was crowned with the seven crowns of the Holy Spirit, symbolical, as he represented, of the precious gifts which he had received from heaven.

But he had kindled fire and flames which he was unable to extinguish. He had incensed the patricians, disgusted the people, aroused the jealousy of the Roman church: his patriotism, his genius, his enthusiasm, all were against him, for all afforded materials for the misrepresentation of his enemies. The Pope excommunicated him, and his soldiers betrayed him; the people overthrew the idol which they themselves had raised; and his seven months' brilliant dream of power was terminated by the revolt of an hour. Rienzi fled from Rome, and found refuge in the Apennines. He then repaired to the court of Charles IV. at Prague, who caused him to be arrested and transferred to the papal court at Avignon (July, 1351), where he languished in confinement for some years. He was sentenced to death, but his life was spared at the intercession of Petrarch. The influence of his name, however, was not extinguished. The Romans forgot the slight excesses of his vanity, or rather the outbursts of his dramatic genius, and remembered only the good he had done and the rigid justice of his rule. When, therefore, to serve his own political schemes, Pope Innocent VI. released Rienzi from prison, armed him with authority, and with the title of "senator" despatched him to govern Rome, he was at first received with enthusiastic demonstrations (1354). The people ushered him into their city amidst the glow of banners and the blare of triumphal music. But Rienzi was no longer the bold and generous tribune. Adversity had hardened his nature. Moreover, he was controlled by a cardinal legate, and exercised only a delegated power. To feed the papal treasury he acquiesced in the imposition of a tax or *gabelle* on wine and salt. Immediately the Romans passed from the delirium of unreasoning joy into the vehemence of unthinking wrath. Their discontent was increased by the very measures which Rienzi adopted to preserve order, and the agents of the patricians took care that it should not smoulder. On the 8th of October they broke out into open revolt, besieged the Capitol, and set it on fire. The senator attempted to escape from the flames disguised as a beggar, but was recognized, seized, and cruelly murdered. He was still in the very prime of his life when his chequered career was thus abruptly terminated, and the sun which had risen so high in pomp and glory suddenly set in shadow and darkness.

Rienzi's great fault was, that he stood in advance of his age. His countrymen could not comprehend the grand projects which his fertile imagination conceived. While he

was dreaming of an imperial Rome, a united Italy, and a golden age, they only sought relief from taxation and red-handed oppression. Added to this, his genius, as we have hinted, was of a visionary and poetic cast, and armed his enemies with weapons against himself. Still, in the circumstances in which he was placed, it may well be doubted whether even the sagacity of a Cromwell or the astute worldliness of an Augustus might not have failed.

His romantic story has been made the subject of an admirable tragedy by Miss Mitford, and of one of the best of Lord Lytton's historical novels. A good sketch of his career will be found in Gibbon's "Decline and Fall of the Roman Empire." The reader should also consult Sismondi, Muratori, and the anonymous "Vita di Cola di Rienzi," by a contemporary, reprinted in 1828.

RIESENGBIRGE or GIANT MOUNTAINS, a chain of considerable elevation, about 120 miles long by 36 miles broad, which separates Bohemia from Prussian Silesia, and is continued westward to the right bank of the Elbe. In different parts it bears different names, as those of Habelschwerdt, Herneheuen, and Wolsehekaurn. It attains its greatest altitude in the Schnee-koppe, 5266 feet, where the Elbe has its source. The Brun or Borenberg, is 5156 feet high, the Grand Sturmlaube ("storm-cap") 4862. The formations are mainly granite and schist. The lower parts of the chain are well wooded, and it pours forth an abundance of waters, which are absorbed by the Elbe, the Spree, and the Oder.

RIETI, the ancient *Reate*, once one of the principal towns of the Sabini, and now an episcopal city of Central Italy, in the province of Perugia, stands on an elevated plain among the western highlands of the Apennines, between two ridges of which lies the basin of the Velino, forming in its lower part the beautiful plain of Rieti. This plain terminates in the magnificent falls of Terni, where the Velino descends into the Nar in a series of beautiful cascades down a total perpendicular height of about 1000 feet. *Reate* was an early and constant ally of Rome, from which it is distant 37 miles. Remains of the Roman baths are still seen in the neighbourhood. In more modern times the people of Rieti were among the first to pay voluntary allegiance to the see of Rome as their temporal sovereign, in the time of Pope Adrian I. The city was often an asylum for the popes in the middle ages, when driven away from Rome by faction or foreign invasion; and so late as 1831 its inhabitants showed their devotedness to the papal see by repulsing the insurgents from Bologna and the Romagna, who were advancing towards Rome. Rieti is built partly on the slope and partly at the foot of a hill; it gives title to an archbishop, has a college, a cathedral, and also manufactures of coarse woollens, silks, glass, and leather. The population amounted to 16,822 in 1881, among whom are many wealthy landed proprietors. The town-house is a massive building in the highest part of the town, and enjoys a splendid view of the surrounding country. The cathedral was built in the twelfth century, and is a very fine edifice. There are several other churches and convents, and an episcopal palace, which are worthy of notice.

RIFLE BIRD (*Ptiloris paradisea*) is a species of birds belonging to the family Paradisideæ (*BIRDS OF PARADISE*). This magnificent bird inhabits the south-eastern corner of Australia, between the Hunter River and Moreton Bay. The general colour of the plumage of the male is a rich velvet black, with a brownish-violet lustre on the upper surface; the feathers of the abdomen and flanks are broadly margined with rich olive-green; the crown of the head and the throat are covered with beautiful scale-like, metallic, bluish-green feathers, and the two middle feathers of the tail are also of a metallic-green colour. The female is very dissimilar. The whole upper surface in this sex is grayish brown, the feathers of the

head having each a white line down the centre; the whole lower surface is buff, paler on the throat, and each feather of the breast and abdomen has a black, arrowed-shaped mark upon it. The bill and feet are black in both sexes. It measures nearly 11 inches. The habits of this bird are imperfectly known. It climbs about on the boughs of trees in the Australian forests, and is said to feed on insects, which it catches by thrusting its tolerably long bill under the loose bark; it probably breeds in holes in trees. It utters a long hissing note, and is said also to make a loud rustling noise with its wings. Further Australia occur two other species, *Ptiloris victorie* and *Ptiloris alberti*.

RIFLED ARMS. See GUN and SMALL ARMS.

RIFLEMEN (called by the French *Tirailleurs*) were soldiers whose duties corresponded nearly to those of light-infantry troops, but their muskets being rifled or grooved, the effect of their fire within certain limits was more certain. The name has nearly lost all meaning, for the whole infantry are now riflemen, though the Rifle Brigade (formerly the 95th regiment) and the 60th regiment (King's Royal Rifles) still retain the old name, on account of former associations. Previous to 1854 these were the only regiments in the British army which were armed with rifles; the others had smooth bore muskets. The rifle volunteer corps is fully described under VOLUNTEERS.

RIG VEDA. See INDIA.

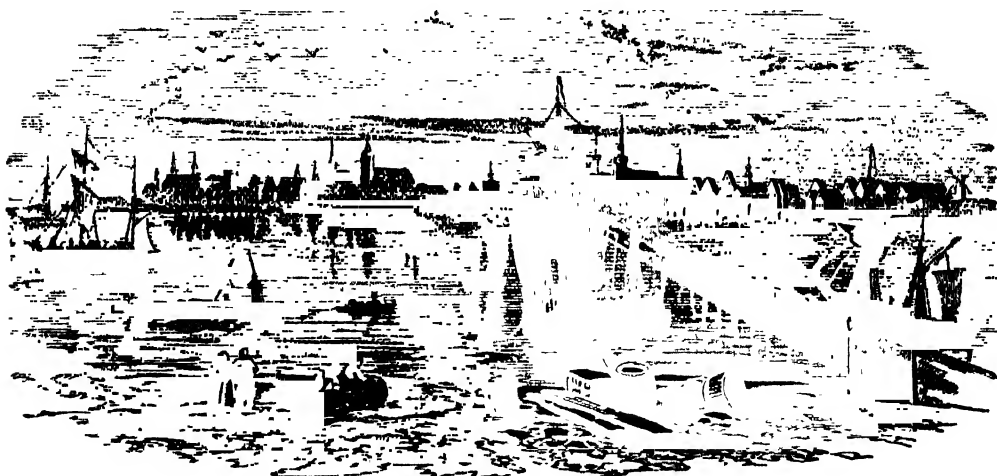
RIGA, the capital of the Russian government of Livonia, is situated on the right bank of the Duna, about 7 miles above its entrance into the Gulf of Riga, and had 169,329 inhabitants in 1881. The width of the river and the distance of the town from the sea make the port very spacious and secure, and the merchantmen come up to the quays. In summer a bridge of pontoons, 40 feet wide and 2600 feet long, loosely attached to piles, and rising and falling with the tide, is laid across the river, which is also crossed by a railway bridge. The town has a strong citadel, and is otherwise well fortified. There are three suburbs rapidly increasing in size. The principal public buildings of the town are—a Lutheran cathedral, St. Peter's (the steeple of which is said to be the highest in the empire), and a great number of other churches; the castle, built in 1201; an imperial palace, with an observatory; the residence of the civil governor; an ancient palace, partly used as the residence of the military governor, partly serving for barracks; the town house, containing the exchange; the assembly house of the estates of Livonia; the arsenal; the hospital of St. George; the Catherineuhof, a bomb-proof warehouse 445 feet in length; and a theatre. There is also a column with a colossal bronze statue of Victory; and numerous literary and useful institutions, including several colleges, a school of navigation, a public library with many rare manuscripts, a cabinet of natural history, and a society of Lithuanian literature. The old part of the town is dark and gloomy, but the modern one is handsome.

Riga is the third city of the empire in commercial importance; the numerous ships in the river, the bustle in the streets, and the well-stocked warehouses and shops are indications of the extensive trade of which it is the centre. Out of the large number of vessels which annually enter the port by far the greater part are British. The chief exports are flax, hemp, linseed, corn, wood, Russian leather, tallow, hides, &c. Much of the wood exported consists of ships' masts. These are procured chiefly from districts which border on the Dnieper, and are sent up that river to a landing-place, whence they are transported 30 versts to the Duna, and there being formed into rafts of from 50 to 200 pieces, they descend the stream to Riga. Riga has very considerable manufactures of woollens, rope, tobacco, starch, soap and candles, glass and iron works, and sugar refineries.

The bay of Riga is free from rocks; the inner harbour of the town admits vessels drawing from 12 to 15 feet of water, and ships of larger burden load and unload at Bolder-Åa, a small port outside of the bar, at the mouth of the Dūna, where the custom-house is placed; but the harbour of Riga is in course of improvement. Riga is a

large corn depot. The harbour is open to navigation from three weeks to a month earlier in the spring than St. Petersburg, and is free from ice as much longer in autumn.

Riga was founded about the year 1200, by Albert, the third bishop of Livonia, who established a German colony there. The city grew in importance, and in the thirteenth



Riga.

century joined the Hansseatic League. In 1621 it was besieged and taken by Gustavus Adolphus. In 1710, after a vigorous defence and a fearful slaughter, it was taken by Peter the Great, and annexed to the Russian Empire.

RIGAUDON, the old French dance equivalent to the English *rigadoun*. It is a matter of dispute whether the French took their name from the English (the word being assumed to be connected with *rig*, merry, as we might say a "merry go down"), or the English from the French. The latter seems to be the fact, because the rigaudon was the court dance under Louis XIII., but was not familiar in England till James II. or William III., half a century later. Rousseau's remark that the name came from Rigaud, a dancing-master, is quite unsupported. The dance is almost certainly of Provençal origin. It had a peculiar jump or spring in it. The music is in 2-4 or 4-4 time. The best type of the music to this dance is the famous and very fine rigaudon in "Dardanus," by Rameau.

RIGGING. See SAILS AND RIGGING.

RIGHI, a mountain of Switzerland, in the canton of Schwyz, rising in majestic isolation between the lakes of Lucerne, Lowerz, and Zug, and commanding some of the most magnificent prospects of which even Swiss scenery can boast. Its summit is only 5905 feet in altitude, and is easily accessible by a railway which, by a gradual ascent, goes nearly to the top of the mountain.

RIGHT. The word *right* occurs under some form or other in all the Teutonic languages; and bears a double meaning equivalent to the significations of the Latin word *jus*—namely, *law* and *faculty*.

In its strict sense it means a legal power or claim which can be enforced by legal remedies, or the invasion of which can be punished by a legal sanction. Every right therefore presupposes the existence of positive law.

The modes of acquiring rights are various, and can only be explained in a system of jurisprudence; for example, a person may acquire a right by contract, by gift, by succession, by the fulfilment or non-fulfilment of a condition.

Every right correlates with a legal duty, either in a determinate person or persons or in the world at large. Thus

a right arising from a contract is a right against a determinate person or persons; a right of property in a field or a house, is a right to deal with the field or house availing against the world at large. On the other hand, every legal duty does not correlate with a right; for there are certain absolute duties which do not correlate with a right in any determinate person. Such are the duties which are included in the idea of police; as the duties of cleanliness, order, quiet, at certain times and places.

RIGHT, in mathematics. This term is applied to mathematical language to anything which is imagined in be the most simple of its kind, to distinguish it from others. Thus a right line is a straight line; a right angle is the most simple and well known of the angles used by Euclid; a right cone is one in which the axis is at right angles to the base; and so on.

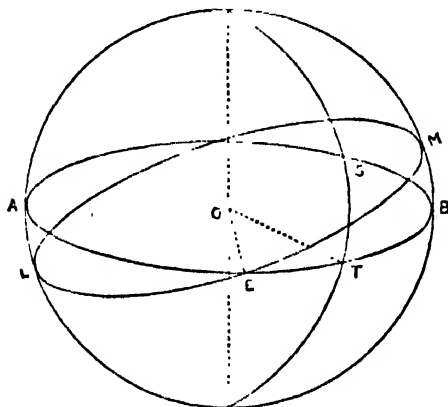
RIGHT ANGLE. When two lines, at first coincident, are made to separate so that one of them revolves about their common extremity, the revolving line will in time become the continuation of the other (180 degrees). This angle or opening, made by a line and its continuation, would, we might suppose, be one of the principal angles considered in geometry, and should, according to the previously-defined meaning of **RIGHT**, be called a right angle. But in the geometry of Euclid the word angle seems to have been essentially connected with the idea of a pointed corner, and we have no means of finding out that he considered a line and its continuation as making any angle at all. Instead of this angle, made by $\angle O$ and $O N$, or the angle

\circ

of opposite directions (the angle of 180 degrees), he introduces its half (90 degrees), and calls it a right angle. Let $\angle O C$ and $\angle O B$ be equal angles, that is, let $O C$ bisect the

angle $\angle AOB$, and each half is called a right angle. When the angle $\angle AOB$ is mentioned, it is as two right angles. The circle is divided, for the purpose of measuring angular degrees, into 360 parts, each of which is called one degree, and since the free extremity of a line turning on the other extremity as a centre, and made to revolve through four right angles, will have described an entire circle, it is manifest that the right angle represents a quadrant or the fourth of a circle, namely, 90 degrees.

RIGHT ASCENSION, a term used in astronomy to denote one of the elements used in fixing the position of a star on the surface of the celestial sphere. Let AEB on the annexed figure represent the equator, and let r be the pole and LEM the plane of the ecliptic. If s be a star,



then the great circle drawn from r to s cuts the equator in T , and the arc ET , between the vernal equinox and the declinate circle is the right ascension of s . It will be seen that all points on the great circle, EST , have the same right ascension, and that the different points on that circle must be specified by their various declinations. [See DECLINATION.] The right ascension may be expressed either by the degrees in the angle $\angle EOT$, or more usually by the time equivalent at the rate of 15 degrees to one hour. The right ascension of an object is determined by observations made either with a transit instrument or a meridian circle. [See TRANSIT INSTRUMENT; MERIDIAN CIRCLE.] The right ascension of a star is the sidereal time of that star crossing the meridian. In the course of time the equinox moves [see PRECESSION], so that from this cause the right ascension of the stars are continually changing, and consequently when the right ascension of an object is given the corresponding date should always be added.

RIGHT, PETITION OF. See PETITION OF RIGHT.

RIGHTS, BILL OF. See BILL OF RIGHTS.

RIGHTS OF MAN, DECLARATION OF THE, a celebrated document drawn up mainly by Dumont, author of the "Souvenirs de Mirabeau," and adopted after much discussion by the French National Assembly, 18th August, 1789. Its publication had been opposed by Mirabeau, and it did not receive the assent of Louis XVI., until after the events of the 5th of October. The declaration, which may be considered an enlargement and amplification of some of the passages of the American Declaration of Independence of 1776, consists of seventeen clauses, of which the following is a summary:—All men are originally free and equal; the ends of social and political union are the preservation of the rights of liberty, property, security, and resistance to oppression; all sovereignty and power exist in and emanate from the nation; liberty consists in the power to do anything which does no injury to another; law is the expression of the national will; all men

should be free to express and communicate their thoughts and opinions; taxation should be divided according to the fortunes of the taxpayers; the elective franchise should be extended to every citizen; and the executive should be responsible to the nation.

Compared with some of the published utterances of modern socialists, anarchists, nihilists, &c., the Declaration of the Rights of Man reads as a very sober and conservative statement; but Burke in his "Reflections on the Revolution in France" referred to the "pultry and blurred sheets of paper about the 'Rights of Man'" as the essence of anarchy. In reply to Burke, Thomas Paine published in English his "Rights of Man," a defence and exposition of the French declaration and the principles of the French constitution, and this publication led to his prosecution for libel on an information by the attorney-general in 1792. He was found guilty in his absence and received sentence of outlawry for the offence.

RIGOR (Greek *rhigéo*, I shiver) is the name given in medicine to a sensation of coldness attended by a fit of shivering. Such fits occur in health when the surface of the body or any considerable part of it is chilled by external cold, and they pass away without leaving any injurious influence when warmth has been restored from external sources or by exercise; but in disease the occurrence of a rigor is often the first sign of disordered health or of the onset of a formidable ailment. In the latter case the symptoms attending the rigor may include a general tremulous movement sufficiently strong to cause chattering of the teeth, paleness and lividity of the complexion, dryness and corrugation of the skin, and a strong feeling of anxiety and discomfort. The breathing also is short and quick, the pulse firm and hurried, and the sensation of cold, beginning at the back, gradually extends to the limbs and the rest of the body. It is a curious physiological fact that in these cases the sensation of cold is actually attended by an increase in the temperature of the body, and a man who sits shivering with the cold is yet proved by the thermometer to be much hotter than when in good health. This rule does not always apply to the extremities, which during a rigor are sometimes colder than usual. It has been suggested that the explanation of this perplexing condition is to be found in the existence of some abnormal differences between the temperature of the surface and of the interior of the body, the surface being colder than the deeper parts, and thus causing, in spite of the general rise in temperature, the sensation of cold. The onset of the malarial fevers, relapsing fevers, scarlatina, erysipelas, and blood poisoning, is marked by rigors of great severity, and in small-pox they are also generally definite and prolonged, but they are less marked in typhoid fever, diphtheria, and measles. Rigors also occur with the access of several local diseases, especially such as end in a gathering and discharge of pus; thus, for instance, the commencement of a gathering in the breast is usually ushered in by a shivering fit, the severity of the gathering being indicated by the length and severity of the rigor. Rigors are also apt to occur during the progress, and just before the bursting of an abscess.

With respect to treatment, warm drinks and external warmth are always grateful to the patient, and may perhaps shorten the duration of an attack. Beyond this there is little that can be done until the diseased condition has manifested itself, and where this is apparent the treatment must be directed to the disease itself rather than the symptoms with which it is associated.

RIGOR MOR'TIS (Lat., the stiffness of death), the name given in medicine to the peculiar temporary rigidity of the muscles which occurs after death, from the coagulation of the muscle-plasma. This rigidity varies so greatly in the period of its occurrence and its duration, that no definite practical rules can be laid down for its observance. In the ordinary way the greater the store of muscular

energy at the time of death the longer it is before rigidity sets in, but this rule is modified when death occurs during great nervous excitement. Soldiers suddenly killed on the field of battle often stiffen immediately in the position in which they fall, the last muscular contraction seeming to pass at once into the rigidity of death, and suicide is sometimes attended by similar phenomena. Where death follows violent and prolonged convulsions, as in cases of tetanus, hydrophobia, strychnia-poisoning, &c., rigidity of the muscles quickly follows, and the same may be said of death preceded by extreme exhaustion, as in cases of prolonged typhoid fever or other weakening disease. The sooner cadaveric rigidity sets in the sooner it is over, and the later it commences the longer it lasts. The muscles are usually attacked in a certain definite order, those of the neck and face being the first to become fixed, then those of the trunk and arms, and then those of the lower extremities. After the lapse of a certain time the coagulated matter liquefies and decomposition commences, the muscles being implicated in the same order in which they were attacked by rigor mortis. Cadaveric rigidity may therefore occur immediately after death or after a few hours, during which the muscles have remained in a state of relaxation. It rarely happens that the rigidity is delayed beyond twenty-four hours after death, but having set in it may last from so short a period as scarcely to be perceptible up to a week or even longer.

RIGSDALER, the old Danish unit of value, the new one being the krone of the Scandinavian Monetary Union. Rigsdalers are still in circulation, however, and prices are often quoted in them. The rigsdaler (or riksdaler) weighs 14.417 grammes of silver, '875 fine; and is therefore worth about 2s. 2½d. English. It is divided into ninety-six skilling.

RIKSDALER is the old unit of monetary value in Sweden and Norway. The Swedish coin is called the *Riksmunt Riksdaler*, i.e. "rixdaler of the royal money," and the Norwegian is called *Riksdaler*, or *Riksdaler Species*.

The *Riksmunt Riksdaler* (Sweden) weighs 8.502 grammes of silver, '750 fine, and is worth about 1s. 1½d. in English. It is divided into 100 öre, and is still in circulation, though the present unit of value is the krone of the Scandinavian Monetary Union.

The *Riksdaler Species* (Norway) is also still in familiar use, notwithstanding the new union coinage. It weighs 28.893 grammes of silver, '875 fine, and is worth about 4s. 5½d. English. It is divided into 5 ørts, and 120 skilling.

RILEVO. See ALTO-RILEVO; BAN-RILEVO.

RIMINI, the Roman *Ariminum*, a considerable town of Italy, in the province of Forlì, with 37,218 inhabitants in 1881, situated near the mouth of the Marecchia, which is here crossed by a handsome marble bridge of five arches and 220 feet long, built to connect the Æmilian and Flaminian roads, in the reigns of Augustus and Tiberius, and still in very good preservation. The sea having receded all along this coast, the ancient harbour of Ariminum is now choked up with sand; but there is a small harbour at the mouth of the Marecchia which admits vessels of light burden, by which Rimini carries on some trade by sea. At the eastern entrance of the town, on the road to Rome, is a fine triumphal arch, erected in honour of Augustus Cæsar. There are also the remains of an amphitheatre. Among the more modern buildings, the most attractive is the Cathedral Church of San Francesco, built by Leon Battista Alberti for Sigismond Malatesta, lord of Rimini, about 1450; the interior is adorned with the sarcophagi and with many memorials of the Malatesta family. The Castel Malatesta, or fortress, is now used as a barrack. Rimini has a library of 30,000 volumes, a museum of antiquities, and a Lyceum. The inhabitants are chiefly engaged in agriculture, and there is some trade in corn and wine.

In antiquity Ariminum was of far more importance than at present. It was the first considerable town on the east coast of the peninsula, after crossing the Rubicon, the boundary between Cisalpine Gaul and Italy properly so called, and was regarded as one of the bulwarks of the latter. A Roman colony was planted in it A.D.C. 485, and at a subsequent period it received another colony. It was occupied by Cæsar immediately after he had crossed the Rubicon, and was honoured with the especial patronage of Augustus. It was given by Pepin, with the rest of the Romagna, to the Holy See, to which, with few intermissions, it belonged till 1860, when it became part of the kingdom of Italy. In the struggles of the middle ages it played a great part under the Malatesta.

RIN is one of the new Japanese coins. It is the thousandth part of a *yen*, and is represented by a small copper coin, worth in our currency about the twentieth of a penny.

RINDERPEST or **CATTLE PLAGUE** is a specific fever of a malignant and contagious type, which, originally occurring in Russian Asia, was introduced by the importation of cattle into Europe. The symptoms of this disease are an increase in the temperature of the infected animal, an eruption in the mucous membranes of the mouth, or, where a cow is affected, of the vagina, a drooping of the head and the ears, fits of shivering and the discharge of a foetid secretion from the mouth, nose, and eyes. The latter signs usually follow about the fourth day after the appearance of the eruption on the mouth, and death generally ensues about a week after the first rise in temperature. The disease is terribly infectious, and where it appears in a herd of cattle it spreads with great rapidity. In 1865 there was a severe epidemic of this disease in Great Britain, and another occurred in 1872, the disease being brought over by imported cattle in both instances. With respect to the treatment of this disease no curative measures are of any avail, the wholesale slaughter of all infected animals and the careful burying of their carcasses being the only effective method of dealing with it. The powers and duties of local authorities and of the Privy Council to make orders as to the rinderpest, foot-and-mouth disease, &c., and places infected therewith; as to the transit, removal, and separation of infected animals; slaughter, compensation, &c., are now regulated by the Contagious Diseases (Animals) Act, 1878 (41 & 42 Vict. c. 74).

RING (Sax. *ring* or *kring*, a circle), a small circle of metal or some other material, in European countries worn upon the finger for ornament or as a marriage symbol, or in the ears, but in many nations employed as a decoration for the legs, arms, feet, toes, neck, and nose. Finger rings are of a remote antiquity. They are mentioned in the Mosiac books; they were worn by the Babylonians, and from Asia were introduced into Greece. Every Greek freeman seems to have worn them. At first they were plain circlets of metal, but afterwards they were adorned with precious stones. The Lacedæmonians despised such vanities, and used rings of iron. In this they were imitated by the Romans until the severe simplicity of republican habits gave way to a love of luxury; and gold rings were confined, as a mark of distinctive rank, to senators, magistrates, the equites, and *proconsuls*. But in the gorgeous days of Imperial Rome every person who could afford it decked his fingers with rings—rings embellished with engraved gems—rings for the different seasons of the year, or for different entertainments. They are scarcely so highly esteemed in modern Europe, yet still are largely worn, and much skill is lavished upon their workmanship and decoration.

Wedding rings seem to have been introduced by the Jews. The form is said to symbolize eternity and truthfulness; they are placed on the woman's left hand as a sign of submissiveness, and on the third finger, because it

thereby pressed a vein which was supposed to communicate directly with the heart. In England wedding rings must be of standard gold, under a statute of 1855. Bishops wear rings on the third finger of the right hand as a sign of ecclesiastical authority.

In old legends and myths rings have always played an important part, from that of Gyges, which made its wearer invisible, to that of Aladdin, which controlled the genii of the lamp. The ring emblemized the supremacy of Venice over the Adriatic, and yearly, on Ascension Day, the Doge cast it with great ceremony from the gilded prow of the Bucentaur into the sea, as a sign and token that the Adriatic was linked to the republic as the wife is to the husband. Signet rings, for sealing important writings, have been in use from a very early period. In the East, as well as in Western Europe, rings were formerly a medium of exchange, a recognized and general currency; and they are still manufactured for African traders for this purpose, of a mixture of copper and iron.

RING-BLACKBIRD or **RING-OUZEL** (*Turdus torquatus*) is a species of bird nearly allied to the BLACKBIRD. The ring-ouzel is a periodical visitant to Britain, arriving in spring, and resorting to the mountain districts to breed. The mountains of Wales, Dartmoor in Devonshire, the rocky districts in Cornwall, the Peak of Derbyshire, the mountains of Scotland and the north of England, and those of Ireland are annually visited. This handsome bird haunts the wildest and most rocky parts of glens or ravines, building its nest, which in form and texture resembles that of the blackbird, on some steep bank under the covert of heath, or some tuft of grass, or on some shelf amid mosses, which conceal it from observation; sometimes it is placed in the fissure of a rock. The male utters his song, consisting of a few clear notes, while perched on the top of some stone, or the summit of a rock. During the breeding time the ring-ouzel becomes very bold, and drives other birds from the vicinity of its nest; it will even fly round dogs and other animals, striking at them,



Ring-blackbird (*Turdus torquatus*).

and uttering loud outcries. The food of this bird consists of insects and their larvæ, snails, slugs, &c. On the approach of autumn it retires southward, and about the end of October leaves us for warmer climates. During the summer it is common in Sweden, France, and Germany, but is very rare in Holland. It passes the winter in Southern Europe and Northern Africa. The ring-ouzel is larger than the common blackbird, and may at once be known by its white crescent-shaped gorget; this is small and less purely white on the female, and in the young males is reddish white. In the winter each feather of its black plumage is broadly edged with grayish-white.

RING-DOVE is one of the English names of the Wood Pigeon or Cushat (*Columba palumbus*). See PIGEON.

RING'ENT, a form of the corolla of plants, so named from the supposed resemblance to the snout and mouth of

some animal. The petals are irregular and gaping. The order LABIATÆ possesses this form of corolla.

RINGS, COLOURED, often called *Newton's Rings*, because Sir Isaac Newton was the first to give (in his "Optics") a sufficient explanation of them, is the name given to the coloured bands which are familiarly seen in soap-bubbles of sufficient tenuity, in thin plates of mica, and generally in any transparent plate of small width, whether bounded by denser or rarer media. If a convex lens of glass, about 10 feet focus, be pressed down upon the plane surface of a glass plate, and white light be incident upon it, the different reflections of the light between the lens and plate give rise to the system of coloured bands. If these be viewed by reflection, the point of contact appears to be black, from the light there being almost wholly transmitted, while each band consists of a gradation of colours from its interior to its exterior border, in the following order:—

First.	Second.	Third.	Fourth.
Black.	Violet.	Purple.	Dull Green.
Faint Blue.	Blue.	Blue.	Pale Pink.
White.	Green.	Green.	Red.
Yellow.	Yellow.	Yellow.	
Orange.	Crimson.	Pink.	
Red.		Crimson.	

In the fifth, sixth, and seventh, the colours are *π* and pink, with a middle white in the fifth, but they are now faint colours, and gradually become invisible.

Newton found the intervals between the plates in the succession of the darkest parts of the several rings to be as the numbers 0, 2, 4, 6, &c., and those corresponding to the brightest parts as the odd numbers 1, 3, 5, &c., the interval corresponding to the brightest part of the first ring being only 178,000th part of an inch. If homogeneous light of any colour be used, the rings of light then produced are all of that colour, intercepted by bands absolutely black.

If we place the glasses between the eye and the source of light, so that the rings may be viewed by that portion of it which is transmitted, we find, as might be expected, that the colours are now complementary to those visible by reflected light.

RINGS, FAIRY. See FAIRY RINGS.

RING'WORM is the popular name for a troublesome disease of the skin of parasitic origin, of a circular figure, and which spreads in the form of a ring. Several forms of this disease are recognized, the more important being those known technically as *tinea tonsurans* and *tinea circinata*, and popularly as ringworm of the scalp and ringworm of the body. Ringworm of the scalp occurs in patches, which vary in size from that of a threepenny piece up to that of half-a-crown, of a rough scurfy character, and having the surface covered with roughened stumps of hair broken at different lengths, and showing a withered and discoloured appearance. There is rarely any redness or inflammation of the patches, but occasionally they are bordered by an inflammatory ring, and the latter may be surmounted with minute pustules. The disease is caused by the presence and growth of a parasitic fungus in the skin and among the roots of the hair called *Trichophyton tonsurans*, which attacks both the hairs and other epithelial structures, causing the hairs to break off and fall away, and the surface of the skin to be covered with opaque white scales. The patches feel thickened and may be hotter than the surrounding scalp, while they are usually attended by itching. The disease is essentially one pertaining to childhood, but it is very contagious and is sometimes communicated to the adult, particularly to women. The treatment of this disease consists, first, in the administration of constitutional remedies so as to improve the general health; secondly, in the removal of the diseased hairs and the destruction of the fungus by a para-

silitide; and lastly, the encouragement of a new growth of hair on the parts left bare by the disease. The first of these measures may be effected by the administration of good food, the influence of good hygienic conditions, and the use of cod-liver oil, iron, and quinine. For the second the hair must be cut with scissors as close as possible all over and round the patch, or if there be many places the whole of the hair should be cut off. The hair having been removed the part affected should be cleared of the stumps of the hairs as far as possible by means of a pair of ciliary forceps, and a hot-water dressing having been applied to moisten and soften the skin, the selected parasiticide should be applied. The best parasiticides are the iodine liniment, sulphurous acid lotion, carbolic acid and glycerine, creosote ointment, and sulphur ointment, which may be variously combined in strength according to the age of the child. Dr. Erasmus Wilson, whose theory of the nature of ringworm was somewhat different to that generally accepted, recommended as the best local treatment moderate friction with iodide of sulphur ointment diluted with two-thirds of benzoated lard night and morning; daily brushing with the hairbrush; and no washing. Where this ointment proved too irritating he proposed the substitution of the nitric oxide of mercury ointment diluted in similar proportion. As the individual affected is capable of spreading the disease from person to person, or of conveying ringworm of the surface to adults, due care should be exercised during treatment, and children suffering from the complaint should be kept from mingling with others who are unaffected. After the disease has been conquered a crop of fine, downy silky hair will be seen springing up over the surface of the place previously affected, and the use of glycerine or borax is then generally sufficient to restore the head or skin to its natural condition.

Ringworm of the body is produced by the same fungus that is present in ringworm of the scalp, but it is an affection of non-hairy parts, and hence it presents a slightly different appearance. It generally begins by a small scurfy spot, which develops into a circular patch having a raised, red, vesicular outer edge with a rough scaly interior. Ringworm of the body often coexists with ringworm of the scalp, and the complaint may pass from the face and neck to the head, or *vice versa*. The parts most usually affected are the forehead, cheek, chin, back of the neck, shoulders, chest, and arms, though it is not limited to any part of the body. The treatment of ringworm of the body is much the same as that of ringworm of the scalp, and it is usually easily cured by the inunction of any of the parasitides already mentioned. The popular remedies of painting the patches with ink or of anointing them with a paste of gunpowder and vinegar are also often sufficient to effect a cure. Dr. Erasmus Wilson recommended that the spots should be pencilled daily with the liniment of iodine until their growth was arrested. Carbolic acid suitably diluted is also a favourite and effectual remedy for these cases. Theoretically both forms of the disease should be readily and easily cured, but in practice they are often found very obstinate and troublesome, and much steady persistence in the use of the means recommended may be required before perfect recovery is attained.

RIO BRAVO DEL NORTE or **RIO GRANDE**, a river dividing Mexico from the territory of the United States, rises in the mountains of South Colorado, in 88° N. lat., 106° 30' W. lon., and flows with a generally south-east course 1800 miles to the Gulf of Mexico, which it enters 30 miles below Matamoras. It is shallow and rapid, and obstructed by many falls and sandbanks; yet small steamers have ascended 450 miles to Kingsbury Falls during the floods of April and May, caused by the melting snows of the mountains. At the "grand Indian crossing," 900 miles from the sea, it is 3 or 4 feet deep, and is forded by the native tribes in their forays.

RIO DE JANEIRO, the capital of the Empire of Brazil, is situated on the western shores, and near the entrance of the Bay of Rio de Janeiro, which extends north and south a length of 17 miles, with a breadth of from 4 to 11 miles, and, being inclosed by high hills, forms perhaps the finest, safest, and most capacious harbour in the world. The entrance to the bay, which is about a mile in width, is defended by batteries and fortresses erected on the promontories on each side and on the island of Lagan.

The town extends along the shore about 3 miles on an undulating plain, the highest point of which is crowned with the church of Nossa Senhora da Gloria. The hills which surround the city are composed of gneiss, intersected by veins of granite. Only a small extent of the town stands south of the hill Da Gloria; the principal part is built north of this hill, on a rocky shore opposite the island Das Cobras.

Rio possesses no imposing street architecture, but has some good public buildings in the European style. The private houses are not outwardly attractive, but villas in the environs evince great taste, and are rendered extremely lovely by tropical flowers, fruits, and foliage. The principal aqueduct, 12 miles in length, brings water to the city, and fountains are numerous. Churches and convents crown the top of almost every hill, but some have remained unfinished for half a century; others are dilapidated, and not a few are deserted. There are several public institutions for the sick and destitute, a theological seminary, a medical college, a fine botanical garden, several banks, military and naval academies, the college of Don Pedro II., a national university, and the national library, containing 120,000 volumes, chiefly brought over from Lisbon. The English residents also have an extensive and valuable library, and a Protestant chapel, built in 1823.

Rio is so placed as to be deprived of the benefit of the land breeze by a range of mountains, and is exposed to suffocating heat, relieved only by the sea breeze in the middle of the day. The mean temperature of the year is 73° Fahr.

Rio de Janeiro contained, in 1886, a population computed at 350,000—about 100,000 of whom were of coloured origin. Most of the inhabitants are engaged in commerce. There are numerous sugar refineries, tanneries, cotton factories, rum distilleries, train oil factories, and diamond-cutting establishments.

Rio is the principal arsenal of the empire, and has several fine docks, both naval and commercial, though the Brazilian ironclads have been generally built in England. Its commerce is extensive and on the increase. The principal exports are cotton, coffee, sugar, hides, rice, tobacco, rum, tapioca, ipecacuanha, timber, manioc flour, gold, diamonds, &c. The imports, chiefly from Europe, include cotton, woollen, linen, and silk manufactures, wines, ironmongery, flour, meat, fish, butter, spirits, earthenware, paper, &c. There is, however, a great coasting trade, and an increasing import from the United States. Several railways, constructed by English labour, already connect Rio with the interior, and others are in course of construction. The city also possesses several steamboat companies, plying daily to various ports situated within the bay, and doing provincial coasting service; and the Brazilian Steam Navigation Company, carrying the mails twice a month to all the northern ports as far as Para, and a branch also twice a month to Rio Grande do Sul and Monte Video. Through the instrumentality of the Rio de Janeiro City Improvements Company, the city was thoroughly drained and lighted with gas. In 1884 the total foreign tonnage entering Rio de Janeiro was 1,383,583, of which 667,570 tons were British. In addition to the magnificent scene presented by the bay, the street life in Rio presents many interesting phases to the stranger. The commerce is vast, and by day the streets are scenes of

great animation. Vehicles are rarely employed in the transport of merchandise to and from the quays, but negro porters, who work in gangs of from ten to twenty, and are generally the most powerful men that can be found. The coffee-carriers are a celebrated race. Under a captain a troop will hoist, each of them, a bag of coffee upon his head, weighing 160 lbs.; and unencumbered by any clothing but short trousers, will start off at a sharp trot which gradually becomes a rapid run. One hand steadies the load; the other grasps a kind of child's rattle, the noise of which is accompanied by a loud shouting song. In the great square the market presents a picturesque spectacle, with its choice fruits, vegetables, poultry, and fish, black cooks, and housemaids chaffering with the vendors. Feather flowers are extensively made of the plumage of the humming-birds, to which the wing cases of beetles are often added, and have the sparkling effect of precious stones. The "padres" in the streets at once arrest the attention of the traveller, with large hats and close-buttoned gowns, dressed in the height of the tropical summer as if for a Canadian winter.

Rio was first founded as a French colony in 1556, with the name of San Sebastian. It was intended to be the capital of a region to be called Antaretic France, but little more than ten years elapsed before the Portuguese took possession of the settlement.

RIO GRANDE DO SUL, a city of Brazil, the capital of a province of the same name, is situated on a low peninsula at the south extremity of the Laguna de los Patos, on the Atlantic, where there is a lighthouse. The population of the town and surrounding district is about 50,000. It has a considerable trade on the lake, but from its low situation is subject to inundations. The commerce of the port, which the deepening of the bar at the mouth in 1882 has greatly improved, is extensive. The principal items of import are salt, wine, flour, provisions, &c.; the chief exports are hides, bones, and "hargre" or dried beef. The province has been remarkable for the successful establishment of European agricultural settlements.

RIOM, a town of France, in the department of Puy-de-Dôme, situated on a height above a fertile plain, 8 miles N.N.E. of Clermont Ferrand. It consists generally of spacious streets, lined with houses substantially built of a dark gray lava, and has fine boulevards and fountains, a court-house, communal college, the remains of an old castle, and a trade in linen, wine, and fruit. The population in 1881 was 10,304. Riom, the *Ricomagus* of the Romans, was formerly the capital of Auvergne and the residence of its dukes, some remains of whose castle still exist. Among the distinguished individuals belonging to Riom may be specified Gregory of Tours and the learned Jesuits J. and A. Sirmond.

RIOT and RIOT ACT. A riot is a misdemeanour at common law. It is defined to be "a tumultuous disturbance of the peace by three persons or more, assembling together of their own authority, with an intent mutually to assist one another against any one who shall oppose them in the execution of some enterprise of a private nature, and afterwards executing the same in a violent and turbulent manner, to the terror of the people, whether the act intended were of itself lawful or unlawful." But if the enterprise is for the purpose of redressing grievances generally throughout the kingdom, or if it has any other general character of violence, the offence is not a riot, but high treason.

Violence, if not of actual force, yet in gesture or language, and of such a nature as to cause terror, is a necessary ingredient in the offence of riot. The lawfulness of the enterprise operates no further than as justifying a mitigation of the punishment. All persons present at a riot who instigate or encourage the rioters, are themselves also to be considered as principal rioters.

The most important Act of Parliament about riots is 1 Geo. I., c. 5, s. 2 (amended as to punishment by the 7 Will. IV. and 1 Vict. c. 91), commonly called the Riot Act. By that statute it is provided that "if any persons to the number of twelve or more, being unlawfully, riotously, and tumultuously assembled together to the disturbance of the public peace, shall continue to assemble for the space of an hour after a magistrate has commanded them by proclamation (usually called 'Reading the Riot Act') to disperse, they shall be considered felons."

By the 7 & 8 Geo. IV. c. 30, s. 8, rioters who demolish or begin to demolish a church or a chapel, a dwelling-house, or any other of the various buildings or machinery mentioned in that Act, are to be considered as felons. Provision is made for remedies against the hundred in case of damage done by rioters.

A question was raised a few years ago whether volunteers can be called in to aid the civil power in case of a riot. It seems to be understood that they cannot serve in their military capacity, but only as special constables and without arms.

RIOUW' or RHIO', a Dutch colony, established in 1817, on the south-west coast of the island of Bintang, which lies opposite Cape Romania, one of the promontories with which the Malay peninsula terminates on the south. After Java, Malacca, and the other Dutch colonies had been restored to the Dutch, the latter intended to make themselves masters of the commerce of the Indian Archipelago, and with that view took possession of the town of Rhio, where they built a fortress; but the foundation of Singapore, 45 miles north-west, and the rapid growth of that British colony, frustrated their design. Rhio is, however, a thriving place. It is visited by many Malay vessels from the adjacent islands, and also by the Siamese. Gambier (an astringent gum), pepper, and rice are the chief exports. The inhabitants are mostly Malays and Chinese, but their numbers are unknown. The town and fortress of Rhio are built at the entrance of a wide inlet, called the bay of Tanjung Pinang. The harbour is good and safe, but at its entrance there are many small rocky islands, which render the navigation difficult and dangerous. Rhio is in 1° 5' N. lat., and 104° 28' E. lon.

RIPON, a market-town, municipal borough, and the see of a bishop of England, in the county of, and 20 miles north-west by west from York, and 222 miles from London, having a station on the North-eastern Railway, is situated near the west side of the Ure, which is crossed by a handsome bridge. The streets are generally narrow, but paved and well built. The town contains a town-hall, grammar-school, hospital of St. Mary, hospital of St. Ann, a market cross, a Roman Catholic church, and a number of other places of worship. The cathedral, though small, is a structure of great beauty. It was commenced by Archbishop Roger in 1154-81; the west part was added by Archbishop Gray (1215-38); the eastern portion of the choir in 1288-1300; the Perpendicular nave and the tower between 1450 and 1510. It was erected into a collegiate church, with a dean and six prebendaries, by James I. in 1604. Extensive restorations were completed by Scott in 1873. The west front is 103 feet high; the nave 87 feet wide. In the crypt, called St. Wilfrid's Needle or oldest portion of the minster, is the narrow passage which was the Yorkshire test of chastity. About a mile from the town is the Episcopal palace, designed by Railton, and built in 1811; Studley Royal, the seat of Earl de Grey and Ripon; and the exquisite ruins of Fountains Abbey, once the richest Cistercian abbey in England. Ripon was much injured by the Scots in 1319, and by the Parliamentary troops in 1613. It was formerly celebrated for its woollen cloth, and for its manufacture of spurs, and the expression "as true steel as Ripon swords" was once proverbial for men of integrity and intrepidity. The city retains, too, some

singular old customs, one of which is the blowing of a horn every night before the mayor's door. The hospital of St. Mary Magdalene for lepers was founded by Archbishop Thurstan (1140), and contains an interesting chapel and a singular stone altar with a tessellated pavement, supposed to be of Roman date, or at all events a very early copy from one of Roman design. It is now used as an almshouse. The corporation consists of four aldermen and twelve councillors, including the mayor. The bishopric was first erected in the seventh century, and revived in 1836. Ripon claims to have been incorporated by King Alfred in 886, though Professor Freeman says that was impossible, and its millenary as a corporation was celebrated with great festivities in 1886.

Ripon derives its name from its position *in ripa* of the river Ure, but whether of Roman or Saxon foundation is wholly unknown. A monastery, founded here A.D. 661, attained considerable celebrity; it was, however, destroyed by the Scots in the reign of Edward II., and was not afterwards restored. Ripon returned a member to the House of Commons until 1885, when it was merged in the county. The population in 1881 was 7390.

RIPPLE MARKS in sand are too familiar to require description, but their importance, from a geological point of view, renders them worthy of brief notice. They are produced by the passage of currents of air or water over loose sand, and their presence upon the surfaces of rocks is therefore an indication of the shallow-water or terrestrial origin of the particular beds in question. In some of the earlier geological formations they occur at all horizons throughout deposits hundreds of feet in thickness, and thus imply that these enormous accumulations of sediment were not formed in great ocean depths, but were laid down in shallow seas, of which the floors were undergoing continual subsidence. When fossils occur in the same rocks they are always of littoral and terrestrial species. (See paper by Professor G. H. Darwin, "On the Formation of Ripple-mark in Sand," read before the Royal Society of London.)

RISK. In the theory of probabilities the risk of loss or gain means such a fraction of the sum to be lost or gained as expresses the chance of losing or gaining it: thus an even chance of losing £40 is considered as a positive loss of one-half of £40, or £20; and two to one for gaining £60 is counted as two-thirds of £60, or £40. If both these risks were encountered at the same time the whole transaction would be considered as a gain of £40 minus £20, or £20, since this is the sum which would be netted by every such transaction in the long run, and one with another.

RITENUTO. See RALLENTANDO.

RITORNELLO (Ital., a returning), in music, a short repetition of the last words or musical phrase of a song or instrumental piece; a burden or close recurring after each verse.

RITUAL (Lat. *ritus*, in the sense of *consuetudo*), the book which directs the rites and ceremonies to be observed in celebrating divine service in any particular church. The ceremonial of the offices of the Roman Catholic Church as administered by the bishops, is regulated by the books entitled "Pontificale" and "Ceremoniale Episcoporum." The priestly offices are set forth in the "Rituale." In the Greek Church the ritual is included in the general collection called "Enchiridion." In the Anglican Church the "Book of Common Prayer" is the principal authority.

RITUALISM, as popularly used, is an extravagant and semi-Roman Catholic phase of public worship in some congregations of the Church of England. There have been always two parties in the Church of England, for it was avowedly founded on a compromise between Puritanism and Popery; and High Church and Low Church have had alternating predominance. Some ceremonies were "taken away which did bind on men's consciences," others

were "retained for discipline and order" (*Preface to Prayer Book*). One party has always tended more to simpler forms, and the other more to the ceremonies of that church whose supremacy Henry VIII. had broken without much change in its doctrine and administration. Hooper had refused to be ordained in the ordinary Catholic costume, and he is a type of the one class; in its more usual and cautious manifestations Crammer and Ridley represented the other. The Prayer Book puts the matter thus: "That no holiness or worthiness was annexed to the garments of the priests; and that while the excessive multitude of ceremonies used in times of Popery was laid aside, some were reserved for a decent order in the church for which they were first devised, and because they pertained to edification, wherunto all things done in the church ought to be referred." This statement leaves ample scope for ritualistic development on the part of those who, by a vague interpretation of its vaguer terms, wish to shelter themselves under it. For they may hold that the form and the colour of clerical robes, the use of incense and lights, with abundance of genuflections and crossings, are for "edification;" while others hold the reverse—that such things are out of all harmony with that spirituality of worship sanctioned and exemplified in the New Testament, and contemplated by the founders of the national church. Under these circumstances it was hard for bishops and lawyers to draw the line beyond which some rites, however fantastic, might be condemned and forbidden. In the case of Martin v. Mackonochie, tried in 1868, it was laid down by the final Court of Appeal that lights on the altar, the use of incense, and the mixing of water with the wine used at the sacrament were illegal. The decision of the judicial committee of Privy Council in 1871 on the case of Herbert v. Purchas still further condemned ritualistic practices. The mere fact, however, that the main features of ritualism are illegal has had little weight with the party, and the numerous difficulties in the way of a general enforcement of the law rendered the most decisive judgments practically inoperative. Even the Public Worship Regulation Act, which was passed in 1874 to provide a more summary means of legal procedure against persistent offenders of the extreme ritualistic type, has been almost a dead letter.

The first important case dealt with by the Act was that of Clifton and others v. Ridsdale, better known as the Folkestone Ritual Case. The charges in the case in question were as follows:—(1) The use of lighted candles on the communion table, or on a ledge immediately over it, at the time of the celebration of the Holy Communion, when the candles were not required for giving light. (2) The mixing of water with wine for the service of the Holy Communion. (3) The use of wafer bread instead of bread such as is usually eaten in the administration of the Holy Communion. (4) Standing at the middle of the west side of the communion table with his back to the people, so that the people could not see him break the bread during the prayer of consecration. (5) Kneeling during the prayer of consecration. (6) Causing the hymn or prayer commonly known as "Agnus Dei" to be sung during the communion service, immediately after the prayer of consecration. (7) Forming and accompanying a procession, consisting of a choir and two acolytes in short surplices and red cassocks, four banners, a brass instrument, and a processional cross being carried in it, the choir singing a hymn, and the respondent walking in it with a cup, called a biretta, on his head; such procession taking place after the service of morning prayer, and immediately before the communion. (8) Forming and accompanying a like procession on another occasion, when, at one period of it, all those who took part in it fell on their knees and remained kneeling for some time. (9) Celebrating the Holy Communion in the vestments known by the names of "chasuble"

and "alb." (10) Celebrating the Holy Communion when only one person besides the respondent received it. (11) Erecting a crucifix in a prominent position in the church, though the judgment held that a removal of the crucifix figure, leaving the cross standing, would be a compliance with the order. (12) Placing round the church figures purporting to represent scenes of our Lord's passion, commonly known as the "Stations of the Cross."

The judgment of the court was against each of the above which thus held to be

The judgment was appealed against on four points—namely, the wearing of the alb and chasuble as "sacrificial vestments," the use of "wafer" bread, the "eastward position," and the erection of a crucifix on the rood screen. The decision of the judicial committee of the Privy Council was given in May, 1877, and was so far unsatisfactory, that the "wafer" was neither definitely allowed nor prohibited—Mr. Ridsdale being victorious only because it was not distinctly proved that he used other than ordinary bread. In like manner the crucifix was condemned—not because such an erection was in itself unlawful, but because no faculty had been obtained for it; and the dispute as to the eastward position was settled by a species of compromise which allows the clergyman to stand facing the east, provided that by so doing he does not prevent the congregation from witnessing his "manual acts." The Eucharistic vestments were condemned as altogether illegal.

RIVER-CRAB (*Thelphusidae*) is a family of crustaceans belonging to the brachyurous DECAPODA or CRABS, distinguished by the quadrilateral carapace and very short antennae. The type of this family is the River-crab (*Thelphusa depressa*), a native of the south of Europe. It is met with in the mud of sluggish rivers and in oozy lakes in Italy, Greece, and Syria, and is much esteemed as an article of diet. Other species of this family abound in India.

RIVER-LIMPET (*Ancylus*) is a genus of GASTROPODA belonging to the family LIMNÆIDÆ (POND-SNAIL). The shell is conical, much like that of a limpet, but more compressed, and with the apex placed further back and sinistral. They are found adhering to stones and leaves in fresh-water springs and streams, and creep with a slow motion. In the animal the head is distinct, the mouth large, and the tentacles two, with the eyes at their inner bases. They are found in Europe, America, and Madeira in running streams attached to stones and aquatic plants.

RIVER-MUSSEL (*Unionida*) is a family of molluscs belonging to the class LAMELLIBRANCHIATA. The river-mussels have a pearly shell covered with a thick epidermis; it is usually regular, equivalve, and closed; the ligament is external, large, and prominent. The animal has a very large, compressed, tongue-shaped foot, which secretes a byssus in the very young stage; the mantle-lobes are usually only united behind to form the siphonal orifices. The sexes are distinct. The eggs are hatched in peculiar brood-pouches of the outer gills. The river mussels are found in fresh-water lakes, rivers, and ponds in all parts of the world. Over 400 species have been described, the greater number from North America.

The typical genus *Unio* contains the Pearl-mussel (*Unio margaritifera*), found in mountain streams of Britain and North America. This species produces pearls, and formerly there were regular fisheries in many of our rivers to obtain them. The Esk and the Conway were famous in this way. The latter river, in the days of Camden, was noted for them. Sir Richard Wynn of Gwydir, chamberlain to Catharine, queen of Charles II., is said to have presented her majesty with a Conway pearl, which is to this day honoured with a place in the royal crown. At Perth there was an extensive fishery in the river Tay, which continued up to the end of last century. Ireland has also produced pearls of

considerable size and some value, especially in rivers of Tyrone and Donegal. The SWAN-MUSSEL (*Anodonta cygnea*) also belongs to this family.

RIVERS. Every copious fall of rain produces a transient flow of water upon the surface of the land, owing to its natural tendency, as of all other bodies, to descend to the lowest accessible level, in obedience to the law of gravitation. But permanent currents, though primarily due to atmospheric precipitation, are either directly referable to springs, or issue from lakes, or are produced by the melting of mountain snows or glaciers. The rill, the rivulet, and the river are three forms of flowing water which differ mainly in magnitude. Issuing commonly from some spring, the rill becomes a rivulet by uniting with kindred currents similarly formed. A number of rivulets contribute by their junction to form a subordinate river, and by the aggregation of such rivers in a common channel a principal river is formed, which reaches its lowest level in ocean, sea, or lake, as the case may be. The main watercourse with all the minor ones, to the remotest and smallest rill and spring, constitute a river system; and the whole country from which supplies are received is called its *basin*, or drainage area, or hydrographical region. In like manner each of the tributary streams has its own area of drainage, forming a sub-basin. An imaginary line joining the sources of all the tributaries, or the points where the waters begin to flow to a common bed, defines the limits of the major and minor basins. The country which separates one basin from another is called the *water-parting*, the drainage from thence being conducted in different directions; and the general slope of the land on either side is termed the *watershed*, of which the ridge and slope of a house-roof affords a rough illustration. The smallest river-basins are in Europe, the largest in America. They vary in extent from 5160 square miles in the instance of the Thames, to 2,275,000 in the case of the Amazon.

The water-partings of the great rivers frequently consist of high mountain ranges, as the main chain of the Alps, with its subordinate ridges, from which the drainage is conducted in four different directions, by the Rhine to the North Sea, by the Danube to the Black Sea, by the Rhone to the Mediterranean, and by the Po to the Adriatic. But very commonly a series of low hills, or a much slighter convexity of the surface, forms the line of separation. This is the case in the gently undulating plain of Eastern Europe, the drainage of which passes by the Niemen and Vistula to the Baltic, by the Volga to the Caspian, by the Don, Dnieper, and Dniester to the Black Sea. In countries where the water-partings are low, they offer facilities for the construction of canals, and thereby distinct river-systems are artificially connected; or, as in Canada, barges are carried across the intervening spaces at the points most favourable for the transport, called *portages*. But there are examples of river-basins so running into each other as for water communication to exist naturally between two primary streams. Thus the Orinoco, in the plain of Esmeralda, then flowing west, sends off a branch to the south, the Cassiquiare, which joins the Rio Negro, one of the principal affluents of the Amazon.

Rivers in general follow a very winding course, owing to the mobility of water, and the obstacles offered to its flow by irregularities of the surface. In many cases the path actually pursued is more than double the distance in a direct line from source to mouth. The Mississippi is specially remarkable for the number of its bends or curvings, which have in many instances a precision suggestive of having been struck by the sweep of a compass. This meandering course of rivers is of high utility, though it adds to the time required for their navigation, for thereby the means of irrigation are afforded to a larger area of the land, the facilities for intercommunication are more widely

extended, and that velocity of the current is prevented which would convert gently flowing streams into impracticable torrents. If a river received no obstruction from its banks, owing to its flow in a perfectly straight channel, with only a very slight inclination, the molecules of water would soon acquire such a momentum under the accelerating force of gravity as to render the stream quite unserviceable for any navigable purpose.

The *fall* of a river, or the amount of its descent from the source to the termination, is a very changeable element, regulated by geological conditions of the country in which it rises, or to which its course belongs. The Volga, issuing from a small lake on the slope of one of the low Valdai Hills, and traversing the plain of Russia, has probably the least fall of any of the great rivers, amounting to only 633 feet, while the Ganges, starting on its course from a bed of snow high up the Himalaya Mountains, has a total fall of 13,800 feet. The greater part of the fall is generally accomplished in the early portion of their course, where they are wild mountain torrents, rushing through ravines, and tumbling over precipices. The force thus given to the molecules of water is often continued long after the channels have lost any marked degree of inclination. Hence many rivers flow with great velocity through comparatively level districts, particularly where the volume of water is large and the depth great. Thus the Amazon, through the last 700 miles of its course, does not fall more than the fraction of an inch per mile, yet so powerful is the current that its fresh water is distinguishable far out in the ocean, and the collision of its stream with the tide of the Atlantic is the occasion of violent disturbance. But rivers do not flow with uniform velocity in all parts of their volume, owing to the retarding agencies which certain portions of the water encounter and others escape, as the abrupt bends and sharp turnings of the channel, the jutting out of masses of rock, and the friction of the aqueous particles against the sides and the bottom. The velocity is greater at the surface than at the bottom, and in the centre than near the banks. According to Sir Charles Lyell, a velocity of 40 feet per minute will sweep along coarse sand; one of 60 feet, fine gravel; one of 120 feet, rounded pebbles; and one of 180 feet, or little more than 2 miles an hour, angular stones of the size of an egg. The average rapidity of the Rhine, Ganges, and Nile, in the middle part of their course, is from 3 to 4 miles an hour; but this is exceeded by the Rhone, probably the most rapid river in the world, with the exception of mere mountain streams. It is this power to carry detritus along according to the velocity of rivers that gives rise to deposits along their course and at their mouths. A sudden check gives rise to bars; a more gradual loss of rapidity by diffusion in the sea originates the *DELTA*.

Some of the commercially important rivers, after being navigable near their source, and continuing so through a considerable distance, assume a strikingly altered aspect, and navigation is either impeded by the change, or rendered wholly impracticable. The useful water-course loses all placidity of surface, and becomes a *rapid*, wildly rushing along with torrent-like speed and violence. This is the effect of a considerable alteration in the inclination of the channel, and has generally for an attendant feature the breakage of the bed into a confused series of disjointed rocks and stones. Many of the finest rivers have their usefulness impaired by these interruptions, and in several cases the aid of science has been called in to aid in removing them by blasting and hydraulic works.

While a steep but gradual slope in the bed of a river occasions a rapid, an abrupt descent, either perpendicular or nearly so, produces a waterfall, properly so called, or cataract. The two features are very commonly combined, and most frequently mark the course of highland streams. But though mountain waterfalls have often great height, and form highly picturesque objects, their volume of water

is in most cases comparatively inconsiderable, and their aspect changes with the season of the year, from roaring torrents in winter to thin rills trickling down the precipices in summer. It is in open and moderately level districts where waterfalls are the least common and their height is unimportant, that the grandest examples occur, owing to the much greater volume of water in the rivers, its unceasing and uniform flow, with the thundering noise of its descent at a single plunge, or by quickly-successive leaps, from a higher to a lower level. The waterfalls most remarkable for mere height are those of the Mamelvan in Norway, 940 feet; the Staubbach in Switzerland, 1000 feet; the Gavarnie in the Pyrenees, 1400 feet; and the Orco at Monte Rosa, 2100 feet.

Rivers are subject to great changes in their volume of water, which occur periodically or at irregular intervals, according to the nature of the producing cause. The periodic variations are either diurnal, semi-annual, or annual. In the upper course of streams which descend from snow mountains, the heat of the sun daily produces high water by the melting of the snow; and the increase is of course the greatest on the hottest days. Those rivers also which either fall direct into the ocean, or discharge in tidal seas, have their level diurnally altered by the flow and ebb. But this applies only to the lower part of their course, or to a certain distance from their mouths, depending upon the amount of the tidal rise, the breadth and shape of the river channels, and the force of their own currents. The broader and more direct the bed of a stream, the further the tide will penetrate, other circumstances being equal, while a narrow and tortuous channel offers obstructions to its progress. Tidal influence is perceptible in the Thames to the distance of nearly 70 miles from its mouth. But in the Orinoco it extends to 255 miles, and in the Amazon to 576 miles. In some British rivers the spring tides rise remarkably high, as much as 60 feet in the Wye at Chepstow. They occasionally signalize their presence by the phenomenon generally known as the *Bore*, called the "heygre" in the Trent and Severn, when a hill of water, with a white ridge of foam, rushes up the stream, and instantly alters its level.

In intertropical countries, and those which border on the tropics, where two seasons divide the year, the one rainy and the other dry, the rivers are subject to a periodical rise and fall from that cause. But those which descend from high mountains are also regularly swollen by the melting of the snow and ice around their sources in spring and summer. Hence an annual inundation upon a grand scale is produced, when the two events are coincident; and a semi-annual rise takes place when they occur at distinct intervals. Many of the subordinate streams also in dry countries oscillate between the extremes of fulness in the wet season of the year and complete exhaustion in the dry.

The extremes of redundancy in the natural water supply, and of deficiency or absolute failure, are nowhere more frequently and strikingly exemplified than in Australia, where the summers are hot and dry, and after long periods of suspension the rain descends in torrents. It is common experience, travelling in the interior, to find a channel which has been recently full to the brim reduced to a bed of parched sand or stones, without a drop of water to quench the thirst of the wayfarer, while many of the larger rivers, under the influence of heat and drought, cease to be continuous, and are converted into a series of detached ponds occupying deep hollows in their beds. On the other hand, the water-courses are more or less liable to floods from the prodigious quantity of rain often precipitated in a very brief shower.

A few important rivers are confined to the interior of continents, with many of minor note, never communicating with the ocean, and are hence styled *continental* rivers. They either discharge their waters in completely land-

locked seas and lakes, or are absorbed and evaporated in sandy deserts, or are lost in swamps and morasses.

The Mississippi, following the Missouri branch, is the longest river in the world, while inferior to the Amazon in the area of its basin and volume of water. But the St. Lawrence, including the great lakes which lie in the valley of the river, and which it contributes to form, is by far the largest body of fresh water upon the face of the globe. According to the lowest estimates, the superficial area of the water is fully 73,000 square miles, and the depth nearly throughout averages more than 600 feet.

The confluence of rivers arrested the attention of mankind in primitive ages, and originated terms descriptive of the physical fact, still in use, but with a slightly altered application. Thus in India, the *Doab*, a word of Sanskrit origin, signifying "two rivers," refers primarily to the Ganges and its affluent the Jumna, but now denotes the country between them. In the same region the *Punjab*, "five rivers," has similarly become the denomination of the territory traversed by that number of principal streams, which blend their waters and descend in a common channel to the Indus. In Western Asia the district included between the Euphrates and Tigris, which come to a junction after a long separate course, received in the classical age the name of Mesopotamia, or "country of the rivers." This is the proper Greek translation of the Hebrew, *Aram Naharaim*, or "Syria of the two rivers," which goes back to patriarchal times. Rivers have been aptly styled the arteries of social life. Though barbarous tribes are largely connected with them, yet civilization first began to dawn along their banks, nor has any nation ever made much independent progress apart from their flow.

We append a list of some of the chief rivers in the different quarters of the globe, with their length and the extent of the area drained by their waters:—

I. ASIA.

	Length Miles.	Extent of Basin in Square Miles.
Amur.	2739	583,000
Euphrate	1716	196,000
Ganges.	1933	432,000
Houng H	2624	540,000
Indus.	2256	315,000
Irawaddi	2532	331,000
Martaban	2152	331,000
Lena	2762	594,000
Yenisei	3322	785,000
Yang-tse-kiang	3314	548,000

II. AMERICA.

Amazons (S. America), . .	3545	2,275,000
Bravo del Norte (N. America),	2138	180,000
MacKenzie (N. America), . .	2440	442,000
Mississippi (N. America), . .	3716	982,000
Orinoco (S. America), . .	1561	350,000
La Plata (S. America), . .	2210	886,000

III. AFRICA.

Nile,	2570	520,000
Zambesi,	2450	435,000

IV. EUROPE.

Danube,	1722	235,000
Dnieper,	1243	170,000
Don,	1104	168,000
Dwina,	1041	106,000
Rhine,	690	65,000
Thames,	220	5,160
Vistula,	598	57,000
Volga,	2762	398,000

V. AUSTRALIA.

Murray,	1300	480,000
-------------------	------	---------

RIVER-SNAIL (Paludinidæ) is a family of GASTEROPODA belonging to the group Holostomata. The shell is conical or globular, covered with a thick olive-green epidermis; the aperture is rounded and entire, and the operculum is concentric, horny or shelly. The animal has a broad muzzle, and eyes placed on short pedicels outside the tentacles, which are long and slender. The river-snails are found in fresh-water lakes and streams in all parts of the world. The species of the typical genus *Paludina* are numerous, inhabiting the rivers and lakes throughout the northern hemisphere, preferring nearly stagnant waters or very sluggish rivers, and feeding on decaying vegetable matter. The Common River Snail (*Paludina ricciipara*) is common in Britain in ditches and marshy waters. This species brings forth its young alive.

RIX'DALER, a Dutch silver coin weighing 25 grammes, .945 fine, and equal to $2\frac{1}{2}$ Dutch gulden, about 4s. 2d. English money.

RIX'DALER SPECIES (of Norway). See RIKSDALER.

RIX'DOLLAR is the English corruption of *Reichsthaler*, imperial thaler, derived from the Dutch equivalent term (not equivalent coin, however) RIXDALER. The Swedish RIKSDALER and the Danish RIGSDALER are other varieties of the word, and are treated of in separate articles.

There are two familiar varieties of rixdollars: (1) A silver coin, value 1s. 6d., made at the British mint for use in Ceylon, divided into twelve *fanams* of $1\frac{1}{4}$ d. each; (2) a silver coin of the same value used at the Cape of Good Hope, divided into eight shillings. The old unit of value in Bremen, worth about 8s. $3\frac{1}{4}$ d. English, was also called rixdollar; it is now, of course, replaced by the new German coinage of *marks* and *pfennigs*.

RIZZIO or **RIC'CIO, DAVID**, an Italian musician in the service of Mary Queen of Scots, chiefly remembered for his tragic death, and the political consequences of which he was unwittingly the cause. He was a Piedmontese of humble birth, who, having accompanied the ambassador of Savoy to Scotland, was noticed by Queen Mary for his musical skill, and gradually promoted in her service until, on the dismissal of her secretary Pualet, she appointed him to the vacant office. She distinguished him with a degree of favour and confidence which angered the haughty nobles of Scotland, and which neither his abilities nor his character seem to have deserved. After the marriage of the queen to Darnley, Rizzio refused to support the pretensions of the latter to the matrimonial crown. He thereby incurred the young noblemen's hatred, and was accused by him of having aspired to the queen's affections. Political intrigues, which Mr. Froude has unravelled with eminent ability in his "History," conspired to render Rizzio an object of pretty general suspicion and detestation; and Ruthven, the Earl of Morton, Douglas, and others joined with Darnley in a scheme to remove "the low-born musician" by assassination. The conspirators surprised him on the evening of the 9th of March, 1565, in the queen's chamber, and in spite of his prayers and her invectives dragged him from her presence, and slew him with six and fifty wounds. His death increased the abhorrence which Mary had already begun to feel for Darnley, and was afterwards terribly revenged by the murder of the latter. See MARY STUART.

ROACH (*Leuciscus rutilus*) is a British fish belonging to the CARP family (Cyprinidæ) and the same genus as the DACE, CHUB, &c. The roach is found throughout Northern Europe in lakes, ponds, and rivers. It is abundant in the Thames. The body is elevated and of a silvery colour, with the lower fins red. It is usually about 10 or 12 inches long, and one weighing over a pound is considered large. The mouth is small. The roach is gregarious, and makes a short migration at the breeding season from lakes

into rivers, and from rivers into smaller tributary streams. It lives principally on small water insects and the spawn of freshwater molluscs. The flesh is in the best condition in October, but is not much esteemed for the table. They afford capital sport for anglers, and will bite well in winter time.

ROADS AND ROAD MAKING. See MACADAM; ASPHALT; APPIAN WAY.

ROANNE, a town of France, in the department of the Loire, situated on the Loire, which is navigable hence downwards, 40 miles north-west of Lyons, and 262 miles from Paris. It is an important railway junction, and being in the vicinity of the St. Etienne coalfield, it has considerable trade besides manufactures of cotton, hosiery, woollen yarn, glue, paper, and chemicals. It is well built, and has a town-house, college, library, theatre, and a fine bridge across the river connecting it with its suburb of La Coteau. The population in 1881 was 24,992.

ROANOKE, a river of the United States, North America, is formed by the confluence of the Staunton and the Dan, flows mostly to the south-east through Virginia and North Carolina, and falls into the Atlantic through Albemarle Sound, after a course of at least 300 miles, for the last 75 of which, to the great falls at Halifax, it is navigable. A canal around the falls opens a boat navigation to its head streams, both of which are navigable for some distance for steamers; and another canal connects it with the town of Washington, on a branch of Pamlico Sound.

ROASTING. In the process of broiling meat the heat is applied immediately and suddenly to the surface, by which it is hardened, so that the juices of the meat are greatly retained, evaporation being thereby prevented; while in roasting the heat is applied gradually, the watery portion is evaporated, as well as the fat melted out to a considerable extent, till the progressive browning and hardening of the surface prevent the further escape of the juices. The loss of weight in roasting meat is much greater than by boiling, much of the fat being melted out and water evaporated, but the nutritious matter remains condensed in the cooked solid; whereas, in boiling, the gelatine is partly abstracted. Roasted meat is therefore much more nutritive than boiled meat, and more digestible.

RO'ATAN, RUATAN, or RATTAN, an island with a fine harbour in the Caribbean Sea, opposite the coast of Honduras. It lies between 10° 5' and 10° 13' N. lat., and between 86° 5' and 86° 35' W. lon., and extends about 30 miles long by 8 broad. The island is one mass of rocks, but covered with a deep soil, which, united to a moist and warm climate, produces a luxuriant vegetation. The woods abound with animals and the coasts with fish. On the southern shores are three small harbours, Port Royal, Dixon's Cove, and Cozen's Cove, from whence turtle, plantains, cocoa-nuts, pine apples, &c., are obtained. This island was discovered by Columbus on his fourth voyage in 1502. Settlements have been made on it from time to time, but it now contains less than 2000 inhabitants. This island was the rendezvous of General Walker and the American filibusters during their repeated attacks on the Central American states.

ROB ROY, the popular name of Robert Macgregor, a famous Highland outlaw, the Robin Hood of Scotland, who has been immortalized by Sir Walter Scott in his celebrated novel of "Rob Roy." Robert Macgregor was born about 1660, and was the son of Donald Macgregor of Glengyle, whose clan was at that time under the ban of the law and the name forbidden. Rob, therefore, assumed the name of his mother, who was a daughter of Campbell of Glenfalloch. He was originally an extensive dealer in cattle, but becoming insolvent in consequence of unsuccessful speculations, he was forced to abscond about 1712, and his estates were seized by the Duke of Montrose in payment of a large loan.

Rendered desperate by his misfortunes, Rob Roy commenced the life of a freebooter with a band of desperate followers. He carried on a fierce predatory war against the Duke of Montrose, whom he considered the author of his outlawry, levied blackmail over a wide district, and mercilessly plundered those who refused to purchase his protection. He was bold, sagacious, and active, and was possessed of great muscular strength. Many tales are told of his daring exploits, and also of his kindness to the poor, whose wants he often supplied at the expense of the rich. He died about 1735, at an advanced age, and his funeral was attended by all the people of the district, with the exception of the partisans of his dual foe.

ROBBERY is now considered to be theft aggravated by the circumstance of the property stolen being taken from the person, or whilst it is under the protection of the person, of the owner or other lawful possessor, either by violence or putting in fear. This offence appears to have been formerly confined to cases of actual violence to the person, but it is now extended to constructive violence by putting in fear; and not only to cases where property has been taken or delivered under a threat of bodily violence to the party robbed or to some other person, but also where the fear has resulted from apprehension of violence to his habitation or to his property, or where it has been occasioned by threats of accusing the party of the commission of an infamous crime.

The party robbed may, without any formality, retake his goods wherever he can find them, unless they have been waived or thrown away by the robber during his flight, or seized by the officer of the king or of the lord of the franchise, or sold in open market. But after such waiver, seizure, or sale, the owner cannot retake them of his own authority. Where there has been no improper neglect to prosecute, the party will, in general, be entitled to his writ of *RESTITUTION*. The party robbed cannot sue for the goods stolen or their value against the robber or any person who may have acquired the goods stolen from the robber, unless he has done all in his power to bring the offender to justice.

Robbery is punishable by penal servitude not exceeding fourteen years, and for any term of years not less than three, or by imprisonment for any term not exceeding two years, with or without hard labour, and with or without solitary confinement during one year of such imprisonment, at the discretion of the court or judge. Flogging, as well as imprisonment or penal servitude, may be inflicted for robberies with violence. Assaulting with intent to rob, and demanding any property of any person by menaces or by force, is made felony punishable in the same manner as actual robbery.

Robbery in Scotland, at common law, is one of the four pleas of the crown, which can only be tried in the justiciary, is *nominally* capital, and therefore not bailable.

ROB'IA, LUCA DELLA, a famous Italian sculptor and worker in enamelled terra-cotta, was born at Florence in 1400. Under the goldsmith Leonardo di Ser Giovanni he there learnt to draw and to model in wax. Having, however, taught himself to work in marble and bronze, he abandoned the goldsmith's art and devoted himself wholly to sculpture. This is Vasari's account; but many recent writers incline to the belief that Luca must have been a pupil of Ghiberte. While still a youth he was employed by Sigismondo di Malatesta, lord of Rimini, to carve the marble ornaments in a monumental chapel he was building. On his return to Florence Luca was commissioned by the wardens of Santa Maria Della Fiore (the cathedral) to execute some bassi-relievi for the famous campanile of Giotto, which excited great admiration; and to carve the marble ornaments on the singing gallery, in which were some admirable figures of singing angels, altogether surpassing the similar gallery of Donatello on the opposite side of

the cathedral. (The gallery has long been taken down, but it is preserved, in pieces, in the Bargello; there is a complete reproduction at South Kensington.) So well satisfied were the wardens with this work that they gave Luca the commission for the great bronze door of the sacristy (1446). On this door, which he divided into ten compartments filled with rilievo, he was employed eleven years. It was greatly admired; but according to Vasari, he found that, from the time expended on this and the previous works, they produced so little profit that he determined to abandon bronze and marble and work in terra-cotta. In this material he was eminently successful, and he invented, or, to be more accurate, he improved, a stanniferous glaze which rendered the material perfectly weather-proof. His first production in this material was a rilievo for the tympanum over his bronze door of the sacristy. Finding these enamelled terra-cottas likely to be very popular, Luca now conceived the idea of adding colour to his figures. In this also he was successful, and the ware—that now known by his name—was received with equal surprise and delight. Cosimo de' Medici gave him a commission to decorate the ceiling and pavement of a study with this coloured ware, and afterwards the central chapel and that of St. Jacopo, in the Church of St. Miniato-al-Monte. So widely was the celebrity of this new sculpturally decorative material spread through Europe that the Florentine merchants began to find it a profitable article of commerce, and kept Luca fully employed at this kind of work, to his great profit, so that he was fain to call in his relatives to assist him. Luca continued to work at his enamelled terra-cotta till his death, which occurred in 1482.

In 1471 Luca was invited to become president of the artists' guild at Florence. He declined because of his age and infirmity, but the invitation shows the great respect in which he was held. The secret of the glaze was preserved in the family, and the manufacture was continued by his nephew, Andrea della Robbia, and Andrea's sons, Luca, Giovanni, and Girolamo. Two other sons of Andrea, Marco and Paolo, also assisted, but falling under the influence of Savonarola, they abjured art and became Dominican monks in his priory. Many of the enamelled terra-cottas of Luca remain in perfect preservation in their original positions; others have been removed uninjured to museums. In the South Kensington Museum are the finest specimens of this work out of Italy, including an altarpiece, &c., by Luca, and others by Andrea della Robbia. The most remarkable, though not the most beautiful specimen, is a massive medallion 11 feet in diameter, one of the largest works of its kind ever made. It was taken from the exterior of the Pazzi Palace, where it was placed to commemorate the visit of King René of Provence to Florence (whose coat of arms and monogram it contains) in 1442; and though exposed there to the weather for 350 years, is still almost uninjured. Indeed if it is let alone Della Robbia's work, like all pottery, is practically indestructible; the busts in the hospital walls of the Annunziata, Florence, are almost as fresh and perfect as the day they were cast. With carelessness, however, it is easily broken. Thus when in 1885 the priceless Della Robbia statuery (terra-cotta) in the Via Nazionale church were given over to the cleaner, the man set his ladder against the neck of one of the apostles, and before he could be stopped, his weight as he mounted the ladder broke off the magnificent head, and it was dashed into a hundred fragments.

ROBERT, King of France, was elected sovereign on the death of his brother Eudes in 898, by the party opposed to the accession of Charles the Simple, the legitimate heir. He fell in battle against his rival, Charles the Simple, near Soissons, on the 15th of June, 923. He was the grandfather of Hugh Capet, founder of the third French dynasty.

ROBERT, surnamed the *Wise*, King of France, sometimes called Robert II., on account of the brief reign of the subject of the preceding article, was the son of Hugh Capet, and on his father's death in 996, ascended the vacant throne at the age of twenty-five. He had married in 995, in opposition to the canons of the church, Bertha of Burgundy, his own cousin in the fourth degree, for one of whose children, by her first husband, he had also stood godfather. In these circumstances Pope Gregory V. excommunicated Robert and laid the kingdom under an interdict. With profoundest regret, after a struggle, Robert separated from Bertha in 998, and thereafter espoused the beautiful Constance, daughter of the Count of Tonlouse, a haughty and vindictive princess. Her severe treatment of her sons drove them into rebellion, and caused the king increasing trouble till his death, in 1031. The relations between Robert and Constance were not unlike those between our own Henry VI. and Margaret of Anjou. Like Henry VI., Robert of France preferred peaceful and devout occupations, while his queen was ever involved in stirring adventures. Robert was somewhat of a musician, and often would retire to St. Denis and sing there in the choir, weary of the intrigues and troubles of state.

ROBERT THE DEVIL, also called the *Magnificent*, was the first Duke Robert of Normandy. He was the father of William the Conqueror, the younger brother of Duke Richard III., and the son of that Duke Richard II., whose sister Emma had been wedded, first to King Ethelred of England, and afterwards to Cnut the Great. In fact, in 1034, Duke Robert fitted out an expedition for England to restore his English cousins to their inheritance, usurped by Cnut, but a storm diverted the enterprise. The princes lived at his court, and one of these succeeded as Edward, called the Confessor. When Duke Robert's illegitimate son William was only seven years old, his father resolved to undertake a pilgrimage to Jerusalem. As he had governed his states wisely his people heard of his intention with alarm and regret; but he persisted in its fulfilment, and making them promise fealty to the boy as his successor in the duchy, he departed. He appears to have had a strong presentiment that he should not return, and he never did; for he died about a year afterwards (1035), on his way home from Palestine. The surname of the "devil" was due to his fearless wild career as a young man, and his immunity from harm in peril, and also to a foul suspicion, quite unfounded, of his having poisoned his brother Richard, the previous duke.

ROBERT II., Duke of Normandy, surnamed *Courte Heuse*, born in 1055, was the eldest son of William the Conqueror, by Matilda, daughter of Baldwin V., earl of Flanders. His history was marked by much vicissitude. Before departing for the subjugation of England in 1066 his father had promised, if he should prove successful, to resign to him the duchy of Normandy, but afterwards he refused to do so, and this led to an unnatural war between the father and the son. They were, however, subsequently reconciled, and when William died he left Normandy to Robert. Robert's younger brothers, William Rufus and Henry Beaulere, who consecutively mounted the English throne, made various attempts to acquire possession of his inheritance, and Robert, on his side, made attempts on England. He governed Normandy very badly, and was in perpetual conflict with his nobles and people. At last he pawned the duchy to his brother, William I. of England, for enough money to fit out an expedition to the Holy Land as part of the First Crusade (1096). While Robert was fighting at Jerusalem William Rufus died (1100), so Henry seized the English crown. Robert hastened home, and resumed the possession of Normandy (1101). He landed in England with an expedition in 1102, but was persuaded by Henry to make peace and return. When the latter was finally settled, however, he quickly made reprisals

on Normandy. Henry was finally successful, and the protracted and sanguinary battle of Tinchebrai, fought on the 28th September, 1106, resulted in the utter ruin of Robert and his cause. The defeated duke was condemned by his merciless brother to confinement for life, and according to some accounts was also cruelly deprived of his eyesight. His adventurous and romantic career was terminated by his death in Cardiff Castle twenty-eight years afterwards, at the age of eighty, in February, 1135. With all his faults Robert had many generous and heroic qualities, which peculiarly endeared him to his friends when living, and, in conjunction with his great misfortunes, caused him to be mourned when dead. His surname is said to have been earned by the shortness of his legs.

ROBERT OF GLOUCESTER, the author of a metrical chronicle of England, is supposed to have been a monk of that city, but nothing of his biography is known with certainty. It seems likely that he was sent to Oxford to preside over the abbey school at Oxford, now Worcester College. His chronicle is a versified narrative of British and English history, from the imaginary arrival of Brutus to the death of Henry III. From a reference which it contains to the canonization of St. Louis, it must have been written after 1297. And from another reference it must have been begun in 1265, for in the account of the battle of Evesham the writer tells about the dark and dismal weather of that day, and adds,

Robert of Gloucester follows Geoffrey of Monmouth and William of Malmesbury, without spirit or talent of his own. His chronicle is printed in rhymed lines of fourteen syllables or seven accents, easily divisible into two lines of eight and six syllables. It has considerable value as a specimen of early English, marked moreover by west of England peculiarities. It was printed by Heaune in 1721, and reprinted in 1810.

ROBERT (GROSSETESTE), Bishop of Lincoln, a scholar and prelate in the early years of the reign of Henry III., was probably born about the year 1175. He studied at Oxford, and went thence to Paris. He returned to England skilled in English, French, Latin, Greek, and Hebrew, and also in logic and philosophy, divinity and the Scriptures, with considerable knowledge of medicine and ecclesiastical law. He obtained preferment in the church, and in 1235 succeeded his patron, Hugh de Wells, in the bishopric of Lincoln, then a diocese of very large extent. This dignity he held for eighteen years. He died in 1253.

Bishop Grosseteste was a great reformer of his diocese, a vigilant superintendent of his clergy, and a strict maintainer of order in all ecclesiastical affairs. Many of his writings have been printed, and others, which remain in manuscript, are found in most of the great libraries of Europe.

ROBERT GUISECARD. See GUISECARD.

ROBERTS, DAVID, R.A., was born at Stockbridge, Edinburgh, 24th October, 1796, and was apprenticed to a decorative painter in Edinburgh, but received some instructions in art in the Trustees' Academy of that city. On the expiration of his apprenticeship he practised as a scene-painter both in Edinburgh and Glasgow. In 1821 he went to London, and for some years pursued the same calling, working for part of the time in conjunction with Stanfield, and with him helping greatly to elevate the character of the scenery in the theatres of the metropolis. While thus engaged, however, he painted some oil pictures, chiefly of architectural subjects: his first picture exhibited was at the British Institution in 1824; his name first occurs among the exhibitors at the Royal Academy in 1826. A folio volume of lithographic facsimiles of his Spanish

sketches, with oil paintings of Spanish buildings and scenery, may be said to have completely established his reputation in 1832. He was elected A.R.A. in 1838, and in the course of the summer started on a tour in the East, during which he made a surprising number of carefully-finished sketches of the architecture and scenery. Facsimiles of these, lithographed by Mr. L. Haghe, were published under the title of "The Holy Land, Syria, Idumea, Arabia, Egypt, and Nubia," in four large folio volumes (1842, &c.) Mr. Roberts, who had been elected R.A. in 1841, continued for some years to paint chiefly views in the East, but with them he occasionally exhibited a Spanish, a Belgian, or a Dutch church interior. In 1850 and following years appeared the results of some Italian tours in views from the canals of Venice, the streets of Verona, the cathedrals of Pisa and Milan, and the glories of ancient and modern Rome; while in 1862 occurred a total change of subject, in a series of "Views of London on the River Thames." All, or nearly all Mr. Roberts' pictures hitherto referred to, are more or less architectural representations, and are the finest works of the kind yet produced by the British school. Roberts died on the 25th November, 1864.

ROBERTSON, FREDERICK WILLIAM, M.A., one of the greatest preachers of the nineteenth century, and who may almost be styled the founder of a new school of religious thought, was born in London on the 3rd of February, 1816. He was the eldest of the four sons of Captain Frederick Robertson, of the Royal Artillery, and when about nine years old was sent to the grammar-school of Beverley, in Yorkshire. A few years later he accompanied his parents to the Continent, where, while sedulously cultivating the classic languages of antiquity, he acquired a thorough knowledge of French. In 1832 he was placed at the Edinburgh Academy, then under the able superintendence of Archdeacon Williams, and speedily distinguished himself by his grasp of intellect and force of character. From thence he removed to the University of Edinburgh, his private studies being directed by the Rev. Charles H. Terrot, afterwards Bishop of Edinburgh. His temperament at this time was delicate and excitable; his feelings, as throughout life, were warm, generous, and deep. His intellectual gifts were such as to command general admiration, though his modesty and reserve of disposition rendered him averse to any public display of them. His parents designed him for the bar, but his enthusiastic nature could not relish the dry links of legal technicalities, and he resolved to enter the army. He was promised an early commission, but a delay took place; and some of his friends, who appreciated the depth and genuineness of his religious feelings, availed themselves of the opportunity to urge upon his father the paramount claims of the church to the services of such a man. The result was that, in obedience to parental wishes, Robertson entered Brasenose College, Oxford, and devoted himself to Christian warfare. Only four days after he had taken this step he received a communication from the War Office, informing him that a commission awaited him in the second regiment of Highland Guards. But he had crossed the Rubicon, and abandoning all thought of

"The pomp and circumstance of glorious war,"

he prepared by careful self-discipline and assiduous mental culture to "fight the good fight." Few nobler spirits have ever girded on the Christian soldier's armour.

His university career was not brilliant in the ordinary sense. He did not seek high honours as a scholar, and, indeed, he positively shrank from all such public displays of intellectual activity. Yet he left an impression on the minds of his tutors and fellow-students that there were few, if any, departments of study in which he was not fitted to excel. Soon after he quitted Oxford he received orders

from the Bishop of Winchester, and accepted the curacy of St. Maurice and St. Mary Kalendar in the cathedral city of the diocese. He laboured in this sphere of duty for about a twelvemonth, earnestly, but with no special success. As yet he scarcely understood his own vocation. Perhaps he was checked by physical failure, for at the end of a twelvemonth his health declined so rapidly as to compel a visit to the Continent, and he travelled through Switzerland, the Tyrol, and some parts of France.

While in Switzerland Robertson married Helen, daughter of Sir George William Denys, Bart., of Easton Neston, Northamptonshire, a lady of handsome person and cultivated mind. Soon afterwards he returned to England, and accepted a curacy under the Rev. Archibald Boyd, incumbent of Christ Church, Cheltenham. He laboured here with eminent success, though his originality of character required a more independent field for uncontrolled exertion. His influence was daily on the increase, when he was called to a new sphere of duty at St. Ebbs, Oxford (1847). Here his eloquent and vigorous preaching soon attracted the undergraduates to his ministry, and he seemed better satisfied with his duties and his performance of them; but he had not yet found a firm and satisfactory footing, nor had he fully developed his extraordinary powers. He was at this time invited to accept the incumbency of Trinity Chapel, Brighton. Having received much kindness from the Bishop of Oxford, he thought himself bound to submit the decision to that prelate, who strongly advised him to accept the post, which, if one of difficulty, was one of honor, usefulness, and influence for good.

Robertson preached his first sermon in Brighton on the 15th of August, 1847, from the text—"For the Jews require a sign, and the Greeks seek after wisdom; but we preach Christ crucified, unto the Jews a stumblingblock, and unto the Greeks foolishness." It was not, as an intellectual effort, equal to many later discourses; but in diction and thought it was so original as at once to convince his hearers that a mind of no common order was thenceforth to be their light and guide. It was the commencement of a career which, if brief, was brilliant, and whose after-influence has been most extraordinary. Sunday after Sunday Trinity Chapel was crowded, and not only by aristocratic auditors, but by shopmen and workmen, all eager, thoughtful, and attentive. Over every subject which he touched Robertson cast the freshness of genius. He so presented it to the mind that a new light seemed to be thrown upon it. Some felicitous illustration, some apposite image, impressed it more keenly and vividly on the hearer's memory. It was impossible to listen to one of his sermons in drowsy indifference. He was constantly striking upon a chain of thought which the mind was forced to take up, link by link, and follow to the end. One special merit of his discourses was their suggestiveness. They set the reader thinking. Another and still greater merit was their earnest tone of sympathy. Robertson had a large heart that throbbed responsive to the sorrows and sufferings of his fellow-men.

Such was Robertson; and such a man, though gathering around him a loyal and earnest band of disciples, could not fail to excite the rancour of a powerful party. He became the object of constant misrepresentation. He was denounced as a socialist, as a Sabbath-breaker, as a neologist; calumny ran riot against him. His efforts to teach religion as a thing of common life—as a thing that was intimately connected with the destinies of nations no less than with the happiness of individuals, as bearing directly upon political and social questions—were persistently derided, perhaps because misunderstood. He felt keenly, for his nature was tender and sensitive as a woman's, the constant slander that buzzed about him. But he knew he was dying, and he had his work to do before the night came. *How* he did it—with what unsparing energy, what marvellous vigour,

what earnest conscientiousness—let the reader examine in his published letters, which most vividly portray the inner soul of the man. None can fail to admire and revere the heroic and self-denying pastor, even if disagreeing with some of the theological views which he espoused. None can fail to sympathize with this enthusiastic and lofty spirit, so resolute to fulfil its mission, so lonely in its fulfilment.

Year by year he grew weaker, but continued to preach almost to the end. After much suffering he died on Sunday evening, the 15th of August, 1853, at the early age of thirty-seven. His life was written in a very satisfactory manner by the Rev. Stopford Brooke (London, 1865), to whose volumes we must refer the reader for fuller information respecting this remarkable man. See also "Robertson of Brighton," by the Rev. Frederick Arnold (London, 1886). Robertson's published writings include four volumes of "Sermons," which have passed through numerous editions; "Lectures and Addresses, chiefly on Literary Topics;" and "Lectures on the Epistles to the Corinthians." They form a valuable addition to theological literature, and have had enormous influence on religious thought and opinion in England and America.

ROBERTSON, DR. WILLIAM, a celebrated historian, was born in 1721, at Borthwick in Scotland, of which parish his father was minister. In 1742 he was presented to the living of Gladsmuir in East Lothian. His first historical work was two volumes on the "History of Scotland during the reigns of Mary and of King James VI." In 1761 Dr. Robertson was made one of the king's chaplains, and in 1762 he was appointed Principal of the University of Edinburgh. Two years after he was named historiographer to his majesty for Scotland, with a salary of £200. In 1769 he published his "History of Charles V.," and in 1777 his "History of America." Dr. Robertson died at Grange House, near Edinburgh, in June, 1793. The research of later writers has rendered his works obsolete, while his style is too dull to gain readers who love literary excellence.

ROBES, MASTER OF THE, an officer of the household who has the ordering of the king's robes. Under a queen, the designation of the office is changed to that of mistress of the robes. It is partly a political office, its occupant going out with the ministry who bestowed the appointment.

ROBESPIERRE, FRANÇOIS JOSEPH MAXIMILIEN MARIE ISIDORE DE, the most famous and the most enigmatical of the Jacobins in the first French revolution, was of Irish descent, his forefathers having emigrated to France in the sixteenth century. He was born at Arras in 1758. His father was a provincial advocate. Maximilien was the eldest son, and Augustin Bon Joseph the second. There were also two sisters.

Through the kindness of the Bishop of Arras, Robespierre was educated at Paris at the College of Louis le-Grand. Camille Desmoulins was one of his fellow-students there. He studied law, and having returned to his native town followed his father's profession. He gained some little distinction, so as to be named criminal judge for Arras in 1782. It is a most curious fact, but perfectly authentic, that he resigned his office rather than pronounce a sentence of death. After this he worked diligently at his profession, and wrote largely for the press. On the summoning of the States general at Versailles, in 1789, Robespierre was elected a deputy of the Tiers-Etat. It was some time before he gained any influence in the Assembly. He had no personal advantages; he was a short, insignificant looking man; his features small, his complexion biliously pale ("sea-green," as Carlyle calls him with one of his trenchant adjectives), his face deeply marked with the small pox, and his voice thin, though from its sympathetic quality not disagreeable. He was

very poor, but he was above a bribe, and hence he obtained the name of the "incorruptible." It was on the 17th of June, 1789, that he delivered his first speech in the Assembly. From that time he threw off the backwardness and reserve which he had hitherto maintained; but though he was in favour of great changes, he was not at first a republican. His importance in the Assembly was in a great measure attributable to the prominent part which he played in the Jacobin Club. This club already contained so many members that the large church was filled in which its meetings were held, and it had corresponding affiliated societies throughout the provinces, which disseminated its views and projects, and rendered its power formidable. When the Assembly determined to call a new Constituent Assembly, to make a fresh constitution for France, Robespierre proposed and carried a resolution that no member of the old assembly should be eligible for the new (May, 1791). Robespierre's exclusion from the Constituent Assembly enabled him, however, to devote his whole time and energies to the direction of the Jacobin movement. He was named public prosecutor for Paris, and served from February to April, 1792.

When the attack was made upon the Tuileries (10th August, 1792), Robespierre shrank from any implication in it. It was his custom neither to take an active part in any violence, nor to appear on the scene immediately after it had occurred—a line of policy to which he was led both by his natural timidity and his great caution. It was with joy that he saw the Constituent Assembly suspend the royal authority and agree to a petition presented by himself (16th August, 1792) pressing them to call upon the nation to elect a Convention, which should determine on a new form of government. He became a member of this Convention, and on its opening (21st September, 1792), seated himself on the "montagne," or higher part of the room, occupied by the most violent, which was also rapidly becoming the most powerful revolutionary party. It was now that Robespierre appeared in the first rank—hitherto he had had superiors even in his own party, such as Brissot and Pétion—and it became his chief object to annihilate the Girondins, representatives of the bourgeoisie, the nearest approach to a middle-class in France, men of culture and refinement. These men hoped, on the other hand, that the eminence which Robespierre had attained might be made the means of his ruin. Barbaroux, Rebecqui, and Louvet accused him of seeking a dictatorship. He demanded leisure to prepare his defence, and absented himself for eight days both from the Convention and the Jacobin Club. During this absence the Jacobins intimidated his accusers, the excitement in the Convention subsided, and on his reappearance he was triumphantly exculpated.

When it was determined by the more violent factions to bring Louis XVI. to trial, Robespierre bravely declared his dissent, but as he denied that the person of a king was inviolable, when Louis was declared guilty he did not hesitate to vote for his death. This terrible event augmented both party strife and private bitterness; each faction and each leader had some rival to destroy. The Montagnards struggled with the Girondins for supremacy, and ended by bringing them to the scaffold. The government fell into the hands of the Committee of Public Safety, of which Robespierre, Couthon, and St. Just were three of the most powerful and active members. Danton had been a member of this famous Committee from April to 10th July, 1793, and Robespierre followed him. Now, since this Committee is responsible for the REIGN OF TERROR, because it was for the time the ruling power in France, it becomes important to see how far Robespierre is to be regarded as the head of the Committee. At first it consisted of nine members, and afterwards of twelve, and after a few changes, from 18th September, 1793, to the death of Robespierre in July, 1794, it remained unaltered, elected

periodically, that is, without any change in its members. These were—Robespierre, Couthon, and St. Just, revolutionary fanatics; Carnot, Lindet, and Billaud de Varennes, men who ought to have been Girondins, and who, with Collot d'Herbois, the two Prieurs and St. André, were the active organizers of the state work, looking on Robespierre as a timid theorist; Héranlt de Séchelles, a friend of Danton and Barrière, a superficial orator, the mouthpiece of the Committee. It is quite clear, then, that Robespierre was always in a minority in this too-famous Committee. The Terror was due, if to any man, to Danton: it was he who cried, "The nations dare us to battle; good; we fling them as our gage the head of a king;" it was he who had sanctioned by his silence (even if he had no hand in them) the September massacres of 1792 in the prisons, forerunner of the Terror of 1793-94, and who had protected such of the criminals as had been discovered. The organization of this monstrous principle, converting Danton's view (probably that of an exemplary slaughter, such as that which served Cromwell at Wexford to cow Ireland with, and really, on the whole, to mercifully spare blood) into a permanent method of government, was due to the Committee of Public Safety, and as their proceedings show, to Collot d'Herbois and Billaud de Varennes. Robespierre had nothing to do with it. The Revolutionary Tribunal and the sovereign power given to representatives "on mission" (an idea taken from Cromwell's "major-generals") existed before he joined the Committee; the Law of the Suspect was not his. The reason that he came to be regarded as the embodiment of the Committee and the instigator of their work was his incessant speaking in the Chamber and at the Jacobin Club, lauding the virtues of revolutionary government and making the bloodstained Terror glow with a pure light. The rest worked often away from Paris; Robespierre talked and theorized, and was visible and audible every day. The guilt of one who apologizes for a criminal is sufficient, but it can hardly be held quite as great as that of the criminal.

In the article REIGN OF TERROR it is shown how the absolute rule of the Committee of Public Safety, voted in September, 1793, at Danton's instigation, was disputed by the Hébertists or Communists. Hébert and his school were for every commune throughout France being supreme, all joining in a federation to form the central government of course, and this meant the downfall of the reign of the Committee. Robespierre not only did not share their ideas, but their coarseness was abhorrent to him. He was no *sansculotte*, but powdered his hair and wore knee-breeches and silk stockings to the day of his death. So, too, when Danton sickened of the continual slaughter, and the Committee once more trembled on the verge, Robespierre retired from public life for a month (13th February to 13th March, 1794) to think out the position. On the 13th March he had resolved on his course, and now his power was to be shown. On the 15th he appeared in the Convention again, on the 19th Hébert and his party were arrested, on the 24th they were guillotined, on the 30th Danton and his friends were arrested, and six days later they too went to the axe. This man, who thought out his acts so coldly, and pushed them home so relentlessly, had struck dire terror to the heart of the Convention itself, where an equally fervent admiration had not been aroused. Friends and foes, whether from love or fear, acted alike, almost deifying the man who had taken the situation thus into his hands and moulded it to his purposes. Further, Robespierre was perfectly incorruptible: he lived by his own work, and lodged humbly at a carpenter's house. Duplay, his landlord, had sheltered him when, in the earlier stages of the movement, his life was in danger, and he had become betrothed to Duplay's daughter Éléonore, deferring their marriage till his enormous labours of speaking, writing, and plotting should be somewhat lessened.

But the very elevation of Robespierre naturally prepared

for his fall. He had only Couthon and St. Just with him. His other comrades had been masters too long to brook the position of servants; it was easy for them to stir up the large party of Dantonists in the Convention, to intrigue with the men of more moderate views eager at any cost to stop the Terror, and thus swiftly to gather an overwhelming force against Robespierre. He on his side pressed forward the machinery of the Terror (1285 victims perishing between 12th June and 28th July, 1794, when he himself died), hoping thus to strike fear into his opponents. It was in vain, every day made them more sure of their strength. On the 8th June, as president of the Convention, he officiated at the festival of the Supreme Being, whose existence he had persuaded the Convention to admit; outwardly he was at the summit of power. Robespierre, however, felt almost immediately after that the insecurity of his short-lived power. He did as he had done in a similar crisis before; he retired altogether from public life to think it all out. After an absence of over a month he returned. When he spoke for the first time, on 26th July, 1794, he took four hours over his oration; his plans were to end the Terror at once, to punish certain deputies "who had exceeded their functions," and to renew the great Committee. He had not reckoned upon the month's freedom given to his enemies. His talk of punishing the deputies (and which deputies? all asked themselves) aroused general alarm. Next day he was violently attacked, and when he stammered in his reply through nervous eagerness, a roar arose, "The blood of Danton chokes him." The end had come. At noon Robespierre, Couthon, and St. Just were ordered to be arrested, and with them Robespierre's brother and Lebas, the only two men in the Convention who had supported them. Immediately the Commune issued an order that no one was to be admitted to the prisons that day. The communal order was shown by the gaoler, who refused to receive the prisoners, and the latter accordingly took refuge in the Hôtel de Ville, where many of the Jacobins joined them. The Convention declared the whole of these insurgents outlaws, *hors la loi*. At three in the morning Barras and the troops of the Convention met Henriot and the troops of the Commune outside the Hôtel de Ville. Henriot was drunk, his soldiers began to waver at the careful speeches which were addressed to them; Henriot gave way in a panic, rushed into the Hôtel de Ville, and, telling his comrades to save themselves, either leapt, or was thrown by them in anger, out of the window. Some followed him, others tried to hide. All were caught. As for Robespierre he was found with a shattered jaw. Most historians give it that he shot himself, but it was also asserted by a gardener named Méda that he shot Robespierre when in the net of signing appeals to the sections of Paris to take up arms in his favour; and Méda's story was so far believed at the time that he was promoted for his services, and indeed died general and baron. Carlyle, balancing evidence, disbelieves Méda, and gives it, moreover, that Robespierre still held the shent of the pistol in his hand. He had on the skyblue coat in which he had presided seven weeks before at the feast of the Supreme Being. He spoke not. It was six in the morning, 28th July (10th Thermidor), 1794, when the Convention adjourned, after handing over the prisoners to the tribunal to be identified. At four in the afternoon the outlaws, about twenty-three in number, no trial being necessary, only identification, were on their way to the guillotine. Robespierre occasionally opened his eyes when the people clung to the death cart and cursed him louder than usual. He lay with shut eyes on the ground waiting his turn at the scaffold. When they lifted him and tore the bloodstained linen away that bound up the broken jaw, it fell powerless, and a dreadful cry burst from the poor wretch. His was indeed a miserable end.

There has grown up around Robespierre such a mass of legend and prejudice, that even when one knows this it is

difficult to measure the man at his real worth. That he did incalculable harm to his country is true, but it is equally true that he neither gained nor intended personal profit by it. He died as he had lived, incorruptible; the man he lodged with loved him, his brother died for him. No act of personal vengeance can be shown clearly against him. The many crimes he sanctioned, and the far fewer crimes he committed, arose from the narrowness of his views, which made him a slave to the theories he had adopted in his youth from Rousseau and such hare-brained philosophers. He was vain, a good deal of a dandy in a quiet way, a great talker and writer, but with not a particle of grandeur or of statesmanship about him. His power lay in this, that among a selfish crowd he never acted selfishly, his very ambition was by no means of a merely personal sort, and that among a crew of loud talking hypocrites he almost alone really devoutly believed in the truth of what he said, and in the necessity of what he did. Carlyle's "French Revolution" gives a good view of this extraordinary character, but the best life of him is by Ernest Hamel (three vols. Paris, 1867), though it is far too favourable. There are some pretended "Memoirs of Robespierre," but they are a forgery.

ROBIN GOODFELLOW, an English sprite or fairy, the "Puck" of Shakspeare's "A Midsummer Night's Dream," apparently identical with the *Brownie* of Scotland, the *Knecht Rupert* of Germany, and the *Nisse God-dreng* of Scandinavia. He is represented as a mad and merry elf, partial to mischievous pastimes, but chiefly exercising his malicious wit on the idle and dishonest.

ROBIN HOOD. See **HOOD**, **ROBIN**.

ROBIN REDBREAST. See **REDBREAST**.

ROBINIA, a genus of plants consisting of North American trees. The best known species of Robinia is the *Robinia Pseud-acacia* (the bastard or false acacia, or locust tree). It was named locust tree by the missionaries, who supposed it to be the same as that which grows in Asia, and produced the "locusts" spoken of in the New Testament. It was one of the first trees received in Europe from North America. It grows in the Atlantic states, and is abundant in the south-west, in the valleys of the Alleghany Mountains. It is also found in the western states and in Upper and Lower Canada.

Since its first introduction into Europe it has met with very different treatment, at one time being extolled as the most valuable of trees, at another time condemned as worthless. This has arisen in a great measure from the soils and situations in which it has been accidentally cultivated. It has always been known in America as affording an exceedingly hard and durable wood, and has been recommended to be cultivated on this account; but it has a great tendency to form branches, and it seldom attains a large size. In America it is used for making posts, and occasionally trees are found large enough to be employed in shipbuilding; but its greatest consumption was for making treenails, by which the timbers of ships are fastened together, and for this purpose large quantities were formerly used in the royal dockyard at Plymouth.

The tree is of rapid growth when young, and forms heart-wood at a very early age. In America it attains a height of 70 or 80 feet, but in this country it is seldom seen so high. The genus belongs to the order LEGUMINOSÆ.

ROBUSTI, JACOPO. See **TINTORETTO**.

ROC or ROCK, a fabulous bird of immense size, which figures conspicuously in the tale of Sinbad, in the "Arabian Nights' Entertainments." The stories relating to it may be traditions of some extinct ornithological monster, or of some of the larger eagles.

ROCCELIC ACID is a fatty acid found in *Roccella tinctoria* and other lichens. It crystallizes in white needles, melting at 132° C. (269° Fahr.) If heated to 250° C. (482° Fahr.) it gives off water and forms roccellic anhy-

dride ($C_{17}H_{30}O_3$). The formula of the crystallized acid is $C_{17}H_{32}O_4$. It is insoluble in water, but soluble in alcohol and ether. It forms a number of salts having the general formula $C_{17}H_{30}MO_3$, and called roccellates, of which those of the alkalies only are soluble in water. It forms an ether called ethylic roccellate, $C_{17}H_{30}(C_2H_5)_2O_4$; it is a yellow aromatic oil soluble in alcohol.

ROCHDALE, a parliamentary and municipal borough of England, in the county of Lancaster, 200 miles from London and 11 from Manchester. It is the principal station on the Lancashire and Yorkshire Railway, and the parish, which is of very great extent, reaches into the West Riding of Yorkshire. The town is situated on both sides of the river Roche, a tributary of the Irwell, and the different portions of it are united by three bridges. Rochdale participated considerably in the benefits conferred by the Lancashire Public Works Act. The drainage was extended, the gas and water supply augmented, a new cemetery laid out, new streets formed and old ones widened, a large new market-place constructed, and important additions made to the public buildings, in which much architectural ability was displayed. The parish church and St. Mary's were restored, the latter very thoroughly. Among the principal places of worship of importance may be mentioned St. Martin's, St. Alban's, and one at Milnrow, of commanding appearance; a Gothic Congregational chapel, noticeable for its spire; a large Methodist Free Church, Italian style, erected in 1865; and a spacious Gothic cruciform chapel, United Presbyterian, opened in 1869. There are also places of worship for the Wesleyans, Independents, Baptists, Unitarians, Primitive Methodists, the New Connexion, Friends, and Roman Catholics. The finest of the municipal buildings is the Town-hall, opened in 1871. The style is secular Gothic, and its imposing front, which faces the river, is 220 feet in length. The tower and spire, 150 feet high, were burnt in 1883. On the ground-floor is the mayor's reception room, the council chamber, the exchange, committee rooms, &c.; on the first floor the great hall, 90 feet by 56, the news-room, the borough court, refreshment, and other rooms; while the third floor comprises various apartments. The Guildhall was altered and renovated in 1869. Among other buildings of note are the Library of 40,000 volumes, built in 1881; the Infirmary; the savings and other banks; the theatre, erected by a working men's co-operative company; barracks, assembly room, Archbishop Parker's free grammar school, Hardman's and other free schools, and numerous large mills and factories. Rochdale led the way in the great co-operative movement, and the most flourishing instances of its success are to be found here. The manufactures are of very great importance; that of wool has existed from very early times, and is said to have been improved by some Flemings who settled here in the time of Edward III. About 10,000 hands are employed in cotton factories and print works; and 6000 in the baize, flannel, carpet, and other woollen factories, which are distributed in every accessible part of the town and on the neighbouring heights. Hats and machinery are also made here. At Littleborough, by which a Roman way formerly ran, are the tunnels of the railway and the Rochdale Canal, whose summit levels are each between 500 and 600 feet above the sea-level. The canal, uniting westward with the Duke of Bridgewater's Canal and eastward with the Calder and Ribblesdale navigation, 33 miles in length, cost upwards of £600,000, and is supplied by large reservoirs, one of which covers 130 acres. Rochdale returns one member to Parliament. The municipal borough is under the jurisdiction of a mayor, ten aldermen, and thirty councillors. Petty sessions and county courts are held in Rochdale. The boundaries of the borough comprise a circle of 3 miles' radius from the market-place, and include (besides the town of Rochdale) Castleton, Spotland,

Wardleworth, and Wuerdale-with-Wardle. Richard Cobden, the "free-trade apostle," represented Rochdale in Parliament for several years. The population of the municipal and parliamentary borough in 1881 was 68,866. There are remains of the old castle, which belonged to Castleton, a township in which Rochdale was included. The name Rochdale, or Rotehdale and Rachedall, as it was variously spelt, is said to be derived from its situation in the valley of the Roche.

ROCHEFORT, a town and seaport of France, in the department of Charente-Inférieure, situated partly on a hill and partly on a marsh, on the right bank of the Charente, 9 miles from its mouth, and 294 miles from Paris. It had 26,022 inhabitants in 1881. The approach to the town is defended by forts all along the banks of the river. The streets are broad, regularly built, and several of them planted with double rows of acacias and poplars; the houses are low. The chief buildings are—the main hospital, the Hôtel de Ville, museum, library, an observatory, exchange, navigation school, foundling hospital, cemetery, and a civil hospital. The most important feature of the town is its naval port, which contains all necessary accommodation for building and fitting out men-of-war. The commercial harbour, higher up the river, has three large basins with abundant quay room, to the largest of which vessels can have access every day of the year. There are some iron and copper works in the town, with an horlogerie, or clock factory; and a trade in wine, cognac brandy, grain, wood, fish, and salt. Rochefort stands in a pestilential marsh, which, however, has been so well drained, at least in and around the town, that deaths, which were once in eleven, have fallen to one in twenty-six. It was founded in 1666 by Colbert, the minister of Louis XIV. The English (who formerly held all this country till the time of Charles VII.) attempted to capture Rochefort in 1757, but without success; and it was here that Lord Cochrane, in 1809, burnt part of the French fleet.

ROCHEFOUCAULD, DUC DE LA. See LA ROCHEFOUCAULD.

ROCHELLE, LA. See LA ROCHELLE.

ROCHES MOUTONNEES are the rounded bosses or eminences of rock observed in all valleys that have been subjected to the grinding action of glaciers. They were originally so named by the French geologists, from their resemblance, when viewed at a distance, to the backs of sheep. See GLACIERS.

ROCHESTER (called *Dourbroys* by the Britons, *Durobravis* and *Durebromum* by the Romans, and *Hroffceaster* or *Hroffe's Castle*, by the Saxons), a city, parliamentary and municipal borough, and river port of England, in the county of Kent, situated within the bend of the river Medway, on its southern or right bank, immediately adjacent to the parliamentary borough of CHATHAM, with which it forms one continuous town. It is 31 miles E.S.E. from London by the North Kent Railway, and 33 miles by the London, Chatham, and Dover line.

Rochester, a corruption of *Hroffceaster*, existed antecedently to the Roman invasion. During the independence of the Saxon kingdom of Kent it was of importance both as the seat of a bishopric and as a place of strength. After the Conquest William the Conqueror repaired and strengthened a castle here (the noble keep of which, built by Bishop Gundulph, is the finest castellated ruin of the date in the kingdom), and placed it under the command of his brother Odo, bishop of Bayeux.

The city stands chiefly on a low narrow level on the Medway, and is backed by the chalk hills, which rise from the river with a somewhat steep ascent. It consists of several streets, rather irregularly laid out, but its ancient castle and cathedral, the martello towers along the banks of the river, and the works connected with the Chatham lines of fortification, give it altogether a very striking ap-

pearance. Some of the houses are built chiefly of wood, with projecting gables and storeys, and have a very antiquated appearance. The river at Rochester is crossed by an iron bridge of three arches for the road, and a tubular bridge for the London, Chatham, and Dover Railway.

The cathedral, 306 feet long, is situated on the western side of the High Street, within the ancient Priory Gate. The nave is part of the structure of Bishop Gundulph, who rebuilt the cathedral. The west front is a fine specimen of enriched Norman architecture; but the great window on this side is a later insertion of Perpendicular character. The nave has Norman piers and arches, except in the part nearest the choir, where the arches are Early English. Most of the eastern part of the church is plain Early English, of good composition, without much ornament. The choir is 156 feet long, and the nave 150; the great transept 122 feet broad, and the smaller transept 90. Altogether the building presents one of the finest specimens of Norman and Early English architecture to be found in Great Britain. There are a few ancient monuments. Extensive restorations were effected in 1870-75, under the direction of Sir G. Gilbert Scott. The bishopric of Rochester is, next to that of Canterbury, the most ancient in England, having been founded by St. Augustine in 601. The diocese comprises the archdeaconries of Rochester and Colchester. St. Alban's, partly in Kent, but mostly in Essex and Hert's, was separated from it, and created a separate see in 1878. There are three parish churches in Rochester—St. Margaret's, St. Nicholas', and St. Peter's; they are not remarkable for their architecture, but St. Nicholas' has a very ancient stone font. There is also the chapel of St. Bartholomew, attached to the hospital of that name, a very handsome Jewish synagogue, and places of worship for several denominations of dissenters. The castle stands on an eminence on the bank of the Medway, contiguous to the cathedral. Its walls inclosed a quadrangular area nearly 300 feet square, but with their towers they are now in ruins. The architecture is Norman, except the round tower at the south-eastern angle, rebuilt in place of the original square one destroyed by King John. The walls of the keep, 104 feet high and 70 feet square, are still standing, and are singularly massive. The adjoining grounds were laid out as a public park and pleasure grounds in 1872, and these, with the castle, are now the property of the town. The other public buildings are—a commodious guildhall, which was thoroughly renovated in 1868; a clock house, built by Sir Clondesley Shovel; corn exchange, built in 1872; a very handsome county court-house; working men's institute; Henry VIII.'s Free Grammar-school, founded in 1542, and whose usefulness was much increased under a new scheme of administration adopted in 1877. There are several scholarships and also exhibitions to Oxford and Cambridge; Sir J. Williamson's Free Mathematical School, founded in 1701; Hayward's Schools and House of Industry; Watts' House for Travelers, "not being rogues or proctors," founded in 1579; Watts' Almshouses, handsomely built in the Elizabethan style, for aged men and women, with revenues now worth £3500 a year, and out of which capacious baths were constructed in 1874; St. Catherine's Hospital, founded by Symon Potyn in 1316; and St. Bartholomew's Hospital, founded by Bishop Gundulph in 1078, for the benefit of lepers returned from the crusades, and reconstituted in 1858; the present building was erected in 1863. Fort Pitt Hospital and Fort Clarence, which belong to the military establishment at Chatham, are within the city bounds.

Strood and Frindsbury, considerable portions of which have been added to Rochester both by the Boundary and Municipal Reform Acts, are on the north-west side of the Medway—Strood on the London Road, and Frindsbury a little to the north-east. Strood has improved considerably

of late years. Frindsbury Church stands on an eminence commanding a fine prospect. Upnor Castle, on the Medway, is in Frindsbury parish; it consists of an oblong central building, with a round tower at each end, and is surrounded by a moat; it was used during the French war as a powder magazine.

There are extensive agricultural implement manufactures in Rochester. Coal is imported for the interior of the county, and hops are exported. Rochester is 14 miles from the Nore, but trading vessels of heavy burden can come up to the city. The total number of vessels registered as belonging to the port in 1886 was 1150 (51,000 tons). The entries and clearances average 1000 (200,000 tons) per annum. A canal was once constructed from the Medway to the Thames at Gravesend Reach, but the undertaking was not profitable. This canal was carried through the chalk hills by a tunnel 2 miles and 1 furlong in length, commencing near old Rochester Bridge, now used for the passage of the South-eastern Railway.

The corporation the first charter for which was granted by Henry II. in 1165, consists of a mayor, recorder, six aldermen, and eighteen councillors. The parliamentary borough had a population of 21,307 in 1881, and returns one member to the House of Commons. Until 1885 it had two representatives.

ROCHESTER, a town of the United States, in the state of New York, 229 miles west by north from Albany, is situated on both sides of the Genesee, which is crossed by three bridges. The Erie Canal here crosses the Genesee by an aqueduct, and the town is a great railway centre and is well provided with street railways. The Genesee Falls here afford a vast water power, on which the prosperity of the town chiefly depends. It has risen into importance since 1812, when it consisted of only two wooden frame buildings. In 1880 the population was 89,366. It is one of the chief ready-made clothing producers of the United States. It had an extensive lumber, flour, coal, and tobacco business, numerous breweries, and was noted for its fruit and ornamental tree nurseries. The principal institutions and buildings are numerous; charitable homes, asylums, and hospitals, many churches, including places of worship for the Roman Catholics, Baptists, Methodists, Episcopalians, Protestant Episcopalians, Presbyterians, Lutherans, and Jews; a Baptist university, city hall, court house, observatory, and art gallery.

ROCHESTER, EARL OF (JOHN WILMOT), a poet and wit, was born at Ditchley, in Oxfordshire, in 1647. He was one of the profligate companions of Charles II., and it was he who penned the well-known epitaph on that monarch—

"Here lies our sovereign lord the king,
Whose word no man rehes on;
Who never said a foolish thing,
And never did a wise one."

Rochester's death in 1680 (at the age of thirty-three) was undoubtedly hastened by licentiousness; but before his death he became the subject of a remarkable change, and expressed a wish that all his obscene writings should be burned. An account of his conversion is given by Bishop Burnet, under the title of "Some Passages of the Life and Death of John, Earl of Rochester."

ROCHET (Lat. *rochetus*), the lawn or lace surplice, with closely fitting sleeves, which forms a portion of the ecclesiastical costume of bishops, abbots, and other high dignitaries.

ROCK, as employed by geologists, is a term having a somewhat wider meaning than that in which it is ordinarily understood. It is applied to all extensive masses of solid material, not directly derived from animal and vegetable sources, which enter into the composition of the earth's crust. Loose sand and gravel, and unctuous clay, are thus as truly rocks, from a geologist's point of view, as the

hardest quartzites and granites. An account of rock-classification, and the different rock-species, will be found under GEOLOGY, PETROLOGY, and the special articles there quoted.

ROCK CRYSTAL. See QUARTZ.

ROCK DOVE. See PIGEON.

ROCK FAULTS are masses of sandstone occasionally met with traversing coal-seams, and more or less interfering with their continuity. They are variously known to the miners as "horse-backs," "horses," and "lows," and owe their origin to the presence of streams in the primeval jungles, from the remains of which the coal has been formed. Where the water flowed vegetable matter was prevented from accumulating, and the channels were ultimately filled with sediment.

ROCK TEMPLES, temples excavated in the solid rock. See INDIAN ARCHITECTURE.

ROCKET, a cylindrical vessel or case of pasteboard or metal, attached to one end of a light rod of wood, and containing a composition which, being fired, sends the vessel and rod through the air by a force arising from the combustion.

Rockets have long been used as a means of making signals for the purpose of communication when the parties have been invisible from distance or darkness; and they are also used for the purpose of throwing a rope from the shore to a shipwrecked vessel.

Signal rockets are made to weigh half a pound, one pound, or two pounds, and the one-pound rocket is about 16 inches long. The rod is generally attached near the base, and its length is about 8 feet. The composition with which the cylinder is filled consists generally of saltpetre, sulphur, and charcoal or gunpowder, and the composition which produces what are called the stars consists of saltpetre, sulphur, antimony, mealed powder, and isinglass. The latter is dissolved in one quart of vinegar, after which one pint of spirit of wine is added, and then the mealed composition is mixed with the liquid till the whole becomes a stiff paste.

Rockets whose diameters vary from 1 to 2 inches have been found to ascend vertically to the height of about 500 yards, and those whose diameters vary from 2 to 3 inches have ascended to the height of 1200 yards. The distance at which rockets can be seen vary from 35 to 40 miles; and the time of ascent from 7 to 10 seconds.

The rockets invented by Sir W. Congreve were first intended merely as incendiary projectiles, to be thrown from boats into harbours crowded with shipping, but the system gradually expanded until it comprised military as well as naval operations. They were used by us in the bombardment of Boulogne in 1806, when many parts of the town were set on fire by them without any danger being incurred by the attacking party. Rockets were again used at the siege of Copenhagen, in 1807, and were employed with terrible effect by the allied army at the battle of Leipzig. In 1813, in the British artillery service, a body of men called the rocket troop was organized expressly for their management, and improved patterns were subsequently introduced. The weight of a piece of ordnance, and the violent recoil produced, will always render the employment of a gun—even of the lightest description—more or less laborious. Rockets possess neither the drawback of any serious weight nor of recoil, and in warfare with comparatively uncivilized nations they are found to be of great utility. They were used with great effect in Abyssinia, Ashantee, and the Soudan.

As at present constructed a war rocket consists of a cylindrical metal case containing an inflammable composition. The composition consists of the elements of gunpowder, but the proportions are such that when ignited it burns fiercely instead of exploding. Their range is very great, and their full damage may be executed at a distance of fully 1200 yards. See PROJECTILES.

ROCKET, the name of numerous plants of the order CRUCIFERÆ, and belonging to the genera *Brassica*, *Sisymbrium*, *Erysimum*, and the like. The best known species are the Golden Rocket (*Eruca sativa*), an annual whose leaves are eaten as a salad; the Wild Rocket (*Erysimum officinale*), double-flowered Yellow Rocket (*Barbarea vulgaris*), and Garden Rocket (*Hesperia matronalis*).

ROCKHAMPTON, a rising town and river port of Queensland, situated nearly under the line of the Tropic of Capricorn, being in 23° S. lat., on the south bank of the Fitzroy River, which in 1881 was here crossed by a fine suspension bridge, 35 miles from its mouth, at the head of navigation, and about 420 miles north-west of Brisbane. Rockhampton is the port of shipment for a large extent of the back country, and also for the produce of the Peak Downs copper and gold mines. The gold-fields in the vicinity give employment to a number of miners, and the average yield of gold per ton of quartz is second only to that of the Palmer. Minerals are widely diffused; gold, copper, and silver deposits being now worked in various places within a radius of 40 miles of the town. It is also the starting-point of the Central Railway, the other terminus at present being at Bogantungan, 227 miles inland. The town is well laid out; the chief buildings and institutions are the places of worship, including Episcopal, Roman Catholic, Presbyterian, Wesleyan, Baptist, Congregational, Primitive Methodist, and Lutheran churches; the hospital, school of art, government buildings, town-hall, or phlange, chamber of commerce, grammar school, and botanical gardens. There are meat-preserving works, a tannery, soap factories, and a boot factory. The population in 1881 was 7431.

ROCKING STONES, when of natural origin, are produced by the weathering of knolls of rock along joints. They are usually masses of granite or tabular diorite, which weather in the form of rounded blocks, and these are so delicately poised upon their basis, that the slightest force is sufficient to produce an oscillation.

ROCK-LING (*Motella*) is a genus of fishes belonging to the Cod family (GADIDÆ). The rocklings are small fishes with an elongated body covered with minute scales. There are two dorsal fins, the anterior of which is reduced to a narrow rayed fringe partly concealed in a longitudinal groove; there is one anal fin and a separate caudal; the ventral fins are composed of from five to seven rays. Eight species are known, from the coasts of Europe, Iceland, Japan, the Cape, and New Zealand. Five species occur on British coasts. The Five-bearded Rockling (*Motella mustela*) has four barbels on the upper lip and one on the chin. The back is dark brown, becoming lighter on the sides, and white on the belly. The usual length is about 10 inches. It hides under stones and feeds on young fishes and small crustaceans. The other British species are the Four-bearded Rockling (*Motella cimbria*) with four barbels, and the three-bearded rocklings with three barbels, of which there are three species, *Motella tricirrhata*, *Motella macrophthalmus*, and *Motella maculata*. The young are known as "mackerel midge," and were formerly referred to a distinct genus, *Cochia*.

ROCK-SALT. See SALT.

ROCKY MOUNTAINS, or *Chippewyan Mountains*, a lofty range which occupies the central parts of North America, but is much nearer to the Pacific than to the Atlantic. It consists of a continuous broad and elevated belt of parallel mountain chains, and high tablelands between them, which commences in Southern New Mexico, where they are separated by a depression from 50 to 100 miles in width from the mountain system in Mexico, and end on the north-west in the ridges of Alaska. The name "Rocky Mountains," however, is more particularly confined to those portions situated in the United States and British America. This chain is not less than

5000 miles in length, and embraces three distinct grand ranges:—(1) The Coast Range of the Pacific, extending continuously along the shore, at the distance of 10 to 30 miles, from the peninsula of California as far as Vancouver's Island, which is traversed by its prolongation. From this point northwards it is interrupted by the broken coast-line and archipelagoes between lat. 50° and 60°; but it again strikes the coast in lat. 59°, where it forms a lofty group, of which Mount St. Elias, an active volcano, 14,970 feet high, and Mount Fairweather, 14,708 feet, are the principal summits. Further south the heights are less. It seems to be this chain which, bending round west, extends to the Alaska peninsula, and is the immediate link between the American and Asiatic mountains. (2) The Californian Alps, or Sierra Nevada of California, from which the first separates in lat. 35°, is the next chain as we advance inland. It is a direct continuation of the west cordillera of Mexico, south-west of the mouth of the Rio Grande. In its south course it seldom passes 3000 feet; but near the bifurcation north of the head of the gulf, Mount San Bernardino, lat. 31°, attains 11,600 feet, and between 36° and 37° it rises in Mounts Tyndall and Whitney to heights of 14,386 and 14,898 feet. The chain stretches continuously north, bounding California state on the east; traverses Oregon, where a portion of it bears the name of the Cascade R.

altitude, and a distance from the shore of 90 to 120 miles, and declining gradually north, traverses Alaska territory, west of the Yukon River, to Prince of Wales peninsula on Behring's Strait, where the many mountains of considerable elevation. The principal known heights are Shasta Peak, lat. 41° 25', 14,412 feet; Mount Hood, near the Columbia, lat. 45°, 11,225 feet. Mounts Rainier and St. Helen's, a little further north in the Cascade Range, respectively 11,141 and 9750 feet, inactive volcanoes. Further north little is known of this chain. Its western flanks, in California, afford the rich gold deposits. The principal pass from California across the Sierra Nevada is that by which the Pacific railway crosses near Truckee (lat. 39° 20'), 7017 feet above sea-level. (3) The Rocky Mountains proper, the more eastern ranges of the system, are separated from the Sierra Nevada by the wide table-land of the Great Basin. They consist of several cordilleras or ranges, springing from the Anhuac table-land, near Santa Fé, about lat. 35°, and almost uniting with the high southern cordilleras of Mexico. In some parts they are parallel for long distances, in others they inosculate and form mountain knots, the most eastern ridges descending into the Mississippi valley as successive terraces or buttresses to the great table land. One of the most important groups is that which intersects the state of Colorado, in which the Rocky Mountains attain their greatest elevations. From Mount Lincoln, 14,123 feet, 200 peaks, nearly 13,000 feet high, are visible, and about twenty-five of 11,000 and over. Pike's Peak (11,216), Mount Harvard (14,270), and Uncompahgre Peak (14,510 feet) are among the highest of this group. The Wind River Mountains, lat. 42°, lon. 110°, form the great river centre of North America. Here near the base of Fremont's Peak, at an elevation of 13,568 feet, some of them no more than a few paces apart, are the sources of the Missouri, Yellowstone, Platte, Colorado, and Lewis, a principal branch of the Columbia. Here also occurs the most important pass, the South or Fremont's, between lat. 42° and 42° 40', where the axis declines to a height of 7489 feet, affording a very gradual ascent on either side, and giving a ready access to the Great Basin. The highest group lies between the great bend of the Columbia and the sources of the Saskatchewan, in lat. 52°. Here Mount Brown and Mount Hooker are respectively 15,990 feet and 16,750 feet high, and Mount Murchison, 15,789 feet. Two ranges are given off north-east towards the valley of the Mississippi-Missouri. There are the

Black Hills, in lat. 44°, between the north and south forks of the Big Cheyenne tributary of the Missouri, attaining 9700 feet in Harney Peak; and beyond them, north-eastward, the Monteurs des Terres, the watershed between Hudson Bay and the Gulf of Mexico. The geological structure of the chain is imperfectly known. Silurian and carboniferous rocks are known to occur extensively; and on the east base, and on the interior table-lands and valleys opening south, there is a vast development of the cretaceous system. A large region of modern volcanic action, of hot and carbonated springs, with *jets d'eau*, exists towards the sources of the Yellowstone and Madison rivers. Sandstones, with salt beds, exist within the Great Basin.

ROCO'CO, a name given to the debased style of architecture and house decoration which followed the first revival of Italian architecture, and prevailed in Germany and Belgium during the eighteenth century.

ROD, called also a *pole* or *perch*, is a measure of length, equal to 5½ yards or 16½ feet. The square rod is used for measuring masonry and brickwork, and contains 30¼ square yards, or 272¼ square feet; 40 square rods make 1 rood, which is the quarter of an acre.

RODENTIA (*Gilves*, Linn.) is an order of MAMMALIA. The dentition of the Rodentia is highly characteristic. As a rule in adult life there are two large, curved, rootless, evergrowing, chisel-like incisor teeth in each jaw, separated from the molar series by a wide space. These incisors are unfitted for the effective seizure of living prey, or for rending flesh; neither are they adapted for cutting food, but they are most perfect instruments for gnawing. With these weapons, the Rodents (Gnawers) attack the hardest vegetable productions, and frequently feed on wood and bark. The better to effect this object, the incisors have enamel in front only, so that their posterior border being worn away more than their anterior edge, they are always kept set like a chisel. They have no roots, but spring from a persistent pulp, and continue growing throughout life in proportion to the wearing down of their cutting edge; it results from this, that if one of them be lost or broken, its antagonist, meeting with no opposition to keep it within bounds, continues growing in a curve till, if be a lower tooth, it may penetrate the skull above. In the hares and rabbits an additional pair of small incisors is present in the upper jaw, placed behind the functional pair; and in the young of these forms there is a third pair, which soon disappears.

The normal dentition is:—

$$I. \begin{matrix} 1-1 \\ 1-1 \end{matrix}; c. \begin{matrix} 0-0 \\ 0-0 \end{matrix}; pm. \begin{matrix} 1-1 \\ 1-1 \end{matrix} \text{ or } \begin{matrix} 0-0 \\ 0-0 \end{matrix}; m. \begin{matrix} 3-3 \\ 3-3 \end{matrix}$$

In the hares and rabbits there are six premolars in the upper jaw and four in the lower; while in *Hydromys* (a genus of Muridae) the molars are reduced to four in each jaw. The molar teeth are often rootless, and have generally flat crowns with transverse bands of enamel.

The lower jaw is articulated with the skull by a longitudinal condyle, which admits of little lateral movement. The skull is usually rather elongated and flattened on the upper surface; the zygomatic arches are always well developed; the orbits are not separated from the temporal fossae.

There are thirteen dorsal and six lumbar vertebrae. The sternum is usually long and narrow. Clavicles are nearly always present. The hind limbs are often longer than the fore limbs, and in some cases form the sole organs of locomotion. The bones of the forearm (radius and ulna) are always distinct, and often have considerable powers of rotation. The feet are plantigrade or semiplantigrade, usually armed with claws; those of the fore limbs have always five digits, but the hind feet have the digits sometimes reduced to four (hare) or even three (gouti).

The intestines of the animals of this order are very long;

their stomach is simple or slightly divided, and their cæcum (absent in the dormouse) often very voluminous, even more so than the stomach.

The brain (cerebrum) of the rodents is nearly smooth and without convolutions. The eyes are entirely directed laterally; in a few burrowing forms, such as the mole-rat (*Spalax*), they are rudimentary and concealed beneath the skin. The external ears are often large.

Over 900 species of rodents are known. They form the most cosmopolitan family of the Mammalia, the Muridæ occurring even in the Australian region, where no other placental mammals are found. The species are most numerous, and attain the largest size in South America; but none exceed the size of a small pig. They are generally vegetable-eaters, and are for the most part terrestrial in their habits. Some, as the squirrels, are arboreal, a few being even able to take flying leaps in the air by means of a parachute-like membrane of the skin. A few, as the beaver and water-rats, are aquatic. Some northern forms, as the dormouse, pass the winter in a more or less complete state of torpidity.

The accompanying Plates illustrate most of the well-known animals belonging to this order. The order is usually divided into four subordinate groups. The *Sciuromorpha* or Squirrel-like Rodents are divided into the following families:—*Sciuridæ*, containing the squirrels (fig. 1) and marmots (fig. 2); *Anomaluridæ* (flying squirrels). *Haplodontidæ*, and *Castoridæ* (beaver, fig. 3). The *Myomorpha* or Mouse-like Rodents are divided into the great family *Muridæ* (mice and rats, figs. 5, 6). *Myoxidæ* (dormouse, fig. 4), *Spalacidæ* (mole-rats), *Geomyidæ* (pouched rats), and *Dipodidæ* (jerboas, figs. 7, 8). The *Hystricomorpha* or Porcupine-like Rodents contain the *Hystricidæ* (porcupines, fig. 10), *Octodontidæ* (cavy, fig. 9, &c.), *Chinchillidæ* (chinchillas), *Dasyproctidæ* (agoutis), *Dinomylidæ*, and the *Caviidæ* (cavies). The *Lagomorpha* or Hare-like Rodents contain only two families, *Leporidæ* (hares and rabbits, fig. 11), and *Lagomylidæ* (calling-hares, fig. 12). This last suborder differs from the rest of the order in having two pairs of incisors in the upper jaw, and hence is often called *Duplicidentati* (double-toothed).

Fossil Rodentia are abundant in the Tertiary deposits and in various caverns, often in prodigious quantities.

RODERIC, the thirty-fourth and last of that race of Visigoth kings who filled the throne of Spain from 414 to 711. Roderic revolted against his sovereign Witiza in 708, deprived him of the crown, and banished him to Toledo. The sons of Witiza crossed over to Africa, where they were kindly received by Ilyan (the Count Don Julian of the chronicles), lord of Ceuta and Tangiers, and the invasion and conquest of Spain by the Moors, under Tarik ben Zeyad, was the consequence. Roderic is generally believed to have been killed in the great battle which was fought on the plains of Xeres de la Frontera, or near Medina Silonia, 26th July, 711.

RODNEY, LORD (GEORGE BRYDGES RODNEY), a celebrated English admiral, was born at Walton-upon-Thames, in Surrey, on the 19th February, 1718. He was taken from Harrow School, and sent to sea at twelve years of age. In 1761 Admiral Rodney was appointed commander-in-chief at Barbadoes and the Leeward Islands. Having captured the islands of Martinique, Santa Lucia, and Granada, he was recalled on the conclusion of peace, in 1763. Soon after his return he was created a baronet. He was sent out in 1771 as commander-in-chief on the Jamaica station, and in 1779 on the Barbadoes station. His fleet consisted of twenty-two sail of the line and eight frigates. Before he had been ten days at sea he had captured seven Spanish ships of war, and on 16th January, 1780, fell in with a fleet under Admiral Langara, near Cape St. Vincent, consisting of eleven ships of the line and two frigates. Of these five were taken and two destroyed. On 17th April,

1780, Rodney engaged the French fleet under the Comte de Guichen, near Martinique; only five or six ships supported him, while in his own, the *Sandwich*, he fought a 74 and two 80-gun ships for an hour and a half, compelled them to bear away, and broke through the enemy's line. The admiral was rewarded with the thanks of the House of Commons and a pension of £2000 a year. In 1780 he was chosen to represent the city of Westminster, and was also made a Knight of the Bath. Soon afterwards war was declared against Holland, and instructions were sent to Rodney to attack their possessions in the West Indies. The Dutch island of St. Eustatia surrendered 3rd February, 1781; and in the course of the spring the Dutch colonies of Demerara, Essequibo, and Berbice were captured. Rodney, having returned to Europe in the autumn of 1781, was received with universal enthusiasm, and appointed to the command of the whole of the West Indies. Both the French and Spanish fleets were at this time in the West Indies, and it was intended to form a junction, and attack Jamaica and the other British possessions. The French fleet was commanded by the Comte de Grasse, and consisted of about thirty ships of the line, besides frigates. The British fleet was superior in number of vessels, but inferior in weight of metal. Intelligence having been brought to Rodney, 8th April, 1782, that the French had sailed from Fort Royal Bay, Martinique, he immediately followed. The general action commenced on 12th April, 1782, at seven o'clock in the morning and lasted till half-past six in the evening. Rodney, in the *Formidable*, broke through the French line, engaged the *Ville de Paris*, De Grasse's flag-ship, and compelled her to strike. The result was, that seven ships of the line and two frigates were taken by the British. This action is memorable as the first instance of the successful performance of that well-known manœuvre, which afterwards became a fundamental principle of British naval tactics—namely, breaking the enemy's line. Rodney reached England 21st September, 1782, and was raised to the peerage with the title of Baron Rodney, with an additional pension of £2000 a year. He chiefly lived in the country, till 21st May, 1792, when he died. A monument was erected to his memory in St. Paul's Cathedral, London, at the national expense.

ROE, RICHARD, a fictitious personage used in the old action of ejection together with an equally fictitious opponent, John Doe. See *DOE*.

ROE BUCK (*Capreolus caprea*) is a species of DEER (Cervidæ), a native of temperate Europe and Asia. It was formerly abundant in Britain, but is now most common in the north of Scotland. The antlers are about a foot in length, and divided into three short branches or tynes. The roebuck stands a little above 2 feet high at the shoulder. The hair is of a dark reddish-brown colour, which becomes lighter in winter; the rump is white. It lives in forests, especially where there is a thick growth of underwood. It is not monogamous, as was at one time supposed. The female produces two fawns at a birth. The roebuck displays considerable agility and is very shy. The venison is of inferior quality.

ROE STONE, a vernacular name applied to the rock more scientifically known as OOLITE. It has reference to the fact that the granular texture of the stone renders it very similar in appearance to the roe of a fish.

ROGA'TION DAYS (Lat. *Feria Rogationum*). It was a general custom formerly, says Bonrie, and it is still observed in a few parishes, to go round the bounds and limits of the parish on one of the three days preceding Holy Thursday. Spelman considers it an imitation of the Roman terminalia. The primitive custom of the Christians on this occasion was for the people to accompany the bishop or some of the clergy into the fields, where litanies were recited and the mercy of God implored, that he would

avert the evils of plague and pestilence, that he would send them good and seasonable weather, and give them in due season the fruits of the earth. The litanies or rogations then used gave the name of rogation week to this epoch. They occur as early as in 550. In the Prayer Book of the Anglican Church the rogation days are still retained, and are appointed fast days. They are the Monday, Tuesday, and Wednesday before Holy Thursday. The previous Sunday is called Rogation Sunday.

ROGER GUISCARD, as Roger I. of Sicily is sometimes called, was the younger brother of the famous Norman knight, Robert Guiscard. [See GUISCARD.] He joined Robert in Italy in 1058, being then twenty-seven years old, and shared in his adventurous career. In 1071 he assumed the title of Count of Sicily, and in 1089 that of Grand Count, confirmed later on by the Pope. He died in 1101, and was succeeded as Grand Count of Sicily by his son Roger II., then a lad of eight years old. In 1130 Roger II. obtained the title of King from Pope Anacletus. He reigned till 1154.

ROGER OF HOVEDEN. See HOVEDEN.

ROGERS, SAMUEL, F.R.S., F.S.A., author of "The Pleasures of Memory," was born at Stoke Newington, in Middlesex, in 1763. His father was a banker in London, to which firm his son eventually succeeded as a partner. His chief literary productions in addition to the "Pleasures of Memory" were "The Voyage of Columbus" (1812), "Human Life" (1819), and "Italy" (1822-36). All his works cost him years of labour, and they are characterized by much grace and beauty of style; but they lack inspiration. On the death of Wordsworth, in 1850, the post of laureate was offered to Rogers, but was wisely declined by him.

Unlike the needy poets who have too often crowded the ranks of literature, Rogers, for more than half a century, figured in the foremost ranks of London literary society. It is indeed doubtful whether any poet ever lived so much in the smiles of the world as the banker-bard of the West End. He had pronounced himself a Liberal, and with nearly all the Liberals of wit and genius he was in intimate alliance. The hospitalities of his splendid mansion in St. James's Place were ever devoted to their reception and entertainment. He died in 1855.

ROHAN, CARDINAL DE. See DIAMOND NECK-LACE.

ROHILKHAND'. A division of commissionership in the North-western Provinces of British India, comprising the six districts of Bijnour (Bijnor), Moradabad, Budann, Bareilly (Bareilly), Shahjahanpur, and the Tarai. The area of Rohilkhand division is 10,885 square miles, and the population in 1881 was 5,122,557.

RO'LAND, a hero of the time of Charlemagne, whose name has been handed down to posterity in the ancient French chanson, "The Song of Roland." This song was extremely popular during the middle ages, and William the Conqueror had it sung at the head of his troops when on the way to conquer England. Roland is supposed to have been a nephew of the Emperor Charlemagne, and to have materially assisted him in his conquests.

The great event of the Roland myth is really true. There was a real expedition into Spain by Charles the Great, who was beaten back, and on the retreat Roland commanded the rearguard. The Basques cut him off at Roncesvalles, and though they of the main body heard the blast of his horn the signal was either misunderstood or not understood at all, and Roland perished with all his force. Accurate research has fixed Roncesvalles as occurring on the 15th August, 778. But even in the very early "Chanson de Roland," probably composed in England about 1066, we find a traitor Ganelon and other persons and incidents clearly added to the original story; in fact a myth is growing. Later chronicles,

as the "Enfances Roland" (1200), tell of the paladin's childhood, or as the "Chanson d'Aspremont" of his wonderful sword Durandal; others of his love for his comrade Oliver's sister, &c. The myth has always fascinated poets, from these early writers to the elegant Italians of mediæval times, Pulci ("Morgante Maggiore," 1481), Boiardo ("Orlando innamorato," 1486) and Ariosto ("Orlando Furioso," 1516). In Germany there are several statues and pillars of Roland, the *Roland-Säule*. We find one at Bremen, one at Erfurt, one at Halberstadt, one at Halle, one on horseback at Magdeburg, &c.: and there used to be more than there now are. It has come to be thought that this is but a piece of FOLK ETYMOLOGY, and that the landmarks are *Rothland-säule*, red-land pillars; that is, pillars betokening the right to shed blood, the sovereign right of the land where they stood. If statues, they always bear a sword in the right hand. Grimm thinks they are later representatives of the original Teutonic pillars, like the famous *Irmensul* destroyed by Charles the Great.

ROLAND, JEAN, and **MADAME ROLAND**, two of the principal personages of the Girondin party, or that of the bourgeoisie, in the French Revolution. Jean Marie Roland de la Platière was born at Villefranche, near Lyons, in 1732; he was well educated, and easily rose to an honourable government office by promotion. Manon Jeanne Philon was born at Paris in 1754. Her father was an engraver, her mother a woman of superior understanding and amiable temper. Manon in her father's house enjoyed to a certain extent the means of cultivating painting, music, and general literature. At an early age her religious enthusiasm was extreme; in after years it subsided, and her opinions, she confesses, went through every change until they rested in scepticism. Her reading, under her father's roof, was of a most miscellaneous description; her favourite author was Plutarch, who, however, eventually gave place to Rousseau.

At the age of five-and twenty she became the wife of M. Roland, who held the office of inspector of manufactures. Her husband was twenty years her senior, of laborious habits, considerable acquirements, and severe manners. She was fully his equal in knowledge, and considerably his superior in tact and in talent. Though not a beauty, the charm of her face was remarkable, and was equalled by a most fascinating grace of manner, though without a tinge of coquetry. She was tall and finely formed. A daughter was the fruit of this marriage, and Madame Roland's time became divided between the care of her child's education and giving assistance to her husband. With him she visited England, Switzerland, and other countries of Europe—everywhere inquiring into the nature of the civil institutions, and manifesting the warmest sympathy with the advocates of political liberty. The interest with which such a woman regarded the first movements of liberty in her own country may easily be conceived. The Rolands were at Paris in 1791, and their salon soon formed the centre for the republican party. Madame Roland gradually won all over to her own views; never before had woman such unbounded influence. She has been well called the "Queen of the Revolution." During the ministry of the party of the Gironde, Roland was appointed minister of the interior. The talents of his wife were at this time applied to assist him in the composition of public papers, and the famous letter of M. Roland to Louis XVI. (May, 1792) was drawn up by her. This production occasioned his dismissal by the court, for which he was compensated by the warm applause of the Assembly. He again became a minister after the events of the 10th of August; but his party had then passed the bounds prescribed by his judgment, and entered upon extremes repugnant to him and to his high minded and generous wife.

The events of the REIGN OF TERROR are elsewhere

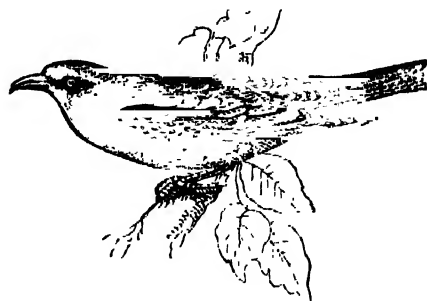
detailed. The frightful massacres in the prisons of Paris on the 2nd and 3rd of September were fearlessly denounced by Roland in his capacity as minister, but from that hour his own doom and that of his wife became only more certain. The day after the king was guillotined he resigned his office. Madame Roland had herself been already arraigned before the Convention on an absurd charge of treasonable correspondence with England, but by her presence of mind, her acuteness, and her wit, had baffled and mortified her accusers. She and her husband soon began to receive warnings of their danger. He deemed it prudent to quit Paris—a course which his wife disdained; and on 31st May, 1793, she was arrested, and thrown into the prison of the Abbaye. She was liberated once, but retaken within the hour. Her place of confinement was soon after changed to Sainte Pélagie, where she was shut up with the most degraded of her sex. The wretchedness of her situation at Sainte Pélagie was only alleviated by her literary occupations and by the kindness of her gaolers, whom her fascinating manners and behaviour converted into friends. She was finally transferred to the Conciergerie, where the queen was also then imprisoned; and here devoted all her time to the composition of her "Memoirs," writings full of lively description, entertaining anecdotes of her contemporaries, and many acute remarks. A letter to her daughter, written in these circumstances, is one of the most affecting of farewells.

It was in October, 1793, that the Girondins were destroyed. On the 31st of that month Madame Roland was sent to the Conciergerie. On the 8th of November she appeared before the Revolutionary Tribunal. Her courage did not desert her during her trial or at her execution. To the last moment she preserved her presence of mind, and even her gaiety. It is said that, bending herself before a statue of Liberty close to the scaffold, she exclaimed, "O Liberty! what crimes are committed in thy name!" and demanded (though in vain) paper and pencil that she might write down the thoughts that were crowding upon her as she waited her turn for the axe. Lamarche seemed nervous: "Let me die first to show him how easy it is," said she. "Contrary to orders," said Sanson the executioner. But she with a light sentence, "Nay, you will not refuse the last request of a lady," passed upward out of her turn. Eye-witnesses speak of her noble figure, clad all in white, her long black hair flowing to her girdle. Her husband stabbed himself a week afterwards on hearing of her death. He was in hiding at Romen. A charming life of the interesting Madame Roland appeared in 1886 from the pen of Miss Mathilde Blind (Eminent Women Series), and in 1884 M. Danban gave complete proof, by four letters written by Madame Roland, while waiting for death in prison, to the brave young Girondin Buzot (Buzot having escaped by flight when arrested), of the fact long suspected, that her undoubted fidelity to her good husband was attained at a great price: she had had, like a good and virtuous wife, silently to stifle a passionate love for another.

ROLLER (*Coraciidae*) is a family of birds belonging to the order *VOLUCRETES*. In this family the bill is elongated and compressed, broad and depressed at the base, and hooked at the tip. The gape is wide, bordered at the base of the upper mandible by a row of bristles. The toes are all free at the base. The Common Roller (*Coracias garrulus*) has a wide range over Europe and Asia in summer, passing the winter in Africa.

In Europe it is found in Denmark, Sweden (where it arrives with the cuckoo), and the southern provinces of Russia; it is more common in Germany than France, where, however, it has been found in Provence; and it has been taken at Gibraltar. In Italy it is rather common, arriving in the spring and departing in September. In Malta and Sicily it is exposed for sale in the shops of poulterers, and is said to have the taste of a turtle-dove. In the Morea it is

considered a delicacy in the autumn, when it is fat with its summer food. It is only an occasional visitor to Britain, but specimens have been killed in almost every county from Cornwall to the Orkneys. It is one of the most beautiful of European birds. The head, neck, and wing-coverts are of a rich greenish-blue colour; the shoulders,



Roller (*Coracias garrulus*).

rump, and tail-coverts are blue; the back, scapulars, and tertials are reddish brown; the wing primaries and secondaries are of a fine verditer blue at the base, with the rest blue black; the two middle feathers of the tail are blackish-green, the remainder bluish-green, the outer feathers on each side being tipped with black; the whole lower surface of the body is pale bluish-green, with the throat verditer blue; and the lower surface of the quill feathers, both of the wings and tail, is rich blue. The feet are yellowish-brown, the bill and claws black. In the male the outer tail feathers are slightly elongated. The whole length of the bird is about 13 inches.

Deep forests of oak and birch appear to be the favourite haunts of the roller. In Asia Minor the roller, which is most common throughout the south and west parts of the country, wherever the magpie is not found (for it is not seen in the same district with that bird), is observed to fall through the air like a tumbler pigeon. It makes its nest in the holes of trees, where it lays from four to seven eggs of a lustrous white. In Malta, where trees are scarce, the bird builds on the ground, in holes in rocks, &c.; where trees are wanting it makes its nest in holes in the clay-banks of rivers. The male takes his turn to sit. It is a shy, noisy, restless bird. It feeds on worms, slugs, insects, and berries. Other species are found in India and Africa.

ROLLER. See AGRICULTURAL IMPLEMENTS.

ROLLIN, CHARLES, born at Paris, 30th January, 1661, was the son of a master cutler, and was intended for the same trade. Attracting the notice of a Benedictine monk, he was placed at the college of Plessis. In 1687 he was made professor of rhetoric at the college of Plessis; and in 1691 he was appointed rector of the University of Paris, and was afterwards persuaded to become principal of the college of Beauvais. In this situation he passed fifteen years, till, being suspected of Jansenism, he was compelled to quit. In 1720 he was again for a short time rector of the University of Paris. In 1726, after he had been forbidden to teach and had in consequence taken to writing, appeared his "Traité de la Manière d'Etudier et d'Enseigner les Belles-Lettres." Encouraged by the general approbation with which this publication was received, Rollin composed his famous "Histoire Ancienne" (1730-38, thirteen vols. 8vo). His last work was a history of Rome, which was afterwards continued by Crevier. He died 14th September, 1741.

ROLLO or HROLF (the ROLL of the Norman writers), the famous ancestor of the dukes of Normandy, was the son of Rognevald, one of the jarls of Harold the Fair-haired,

king of Norway. According to the Icelandic sagas he was so tall and so robust that no horse could carry him, and hence the appellation of "Gangr" or the Walker (Rolf the Ganger). Banished from his country for some picaresque act, he collected a numerous body of followers—the rank of his family and his own personal prowess alike contributing to make him popular—and sailed, in true viking fashion, for the coast of France about 896. Unable to resist the invader, who was continually reinforced by shoals of his Scandinavian countrymen, Charles III., the French monarch, deemed it the wiser policy to cede to him in 912 the portion of his dominions afterwards, from its new lord, styled Normandy (land of the Northmen). There Charles and Rollo met. By the treaty in which the cession was made the former agreed to give his daughter in marriage to the latter, while Rollo and his followers consented to embrace Christianity, and to hold their new possessions as a fief from the French sovereign. A characteristic scene occurred on this occasion. Rollo, now Duke Robert, had to place the king's foot on his neck in token of vassalage; after some demur he consented, but as he stooped to place the king's foot he gave a malicious tilt upwards, which overthrew the monarch's dignity in more senses than one. In 927, fifteen years afterwards, Rollo resigned the dignity to his son, William Longsword, assassinated in 933.

ROLLS, MASTER OF THE, the chief keeper of the records preserved at the Record Office. [See RECORDS.] It is an office of great antiquity (first mention, A.D. 1256) and position. Originally he was merely the custodian of chancery rolls; later he acquired judicial authority in the Court of Chancery; and in recent times he shares with the vice-chancellors the hearing in the first instance of any suit; and by the Judicature Act, 1873, he was made a member of the High Court of Justice and of the Court of Appeal. He is likewise head of the petty bag office (formerly the common law side of the Court of Chancery, now an office in the High Court of Justice), and admits solicitors of the Supreme Court.

ROLLS SERIES, the familiar title of the grand series of antiquarian treasures reprinted by the Record Office, and due to the initiative of Lord Romilly when master of the rolls in 1857. He proposed that the vast body of important historical material in MS. in the Record Office should be edited by competent historical antiquaries, and thus be ordered to be done. A large number of early chronicles and other works have thus been preserved and made intelligible and easily accessible to the general public at moderate cost. The idea had previously been mooted in 1822, when a suggestion of the kind was made to George IV. on the part of the House of Commons; but this must not be allowed to detract from the debt of gratitude owed to Lord Romilly.

ROMAGNA, a name which was given in the middle ages to a tract of country north of the Apennines, corresponding to the former Papal legations, Bologna, Ravenna, Ferrara, and Forlì. The name Romagna or Romandiola, "little Rome," is said to have been given to it in consequence of the exarchs having fixed their residence at Ravenna, which thereby, as the seat of the imperial government in Italy, became a second Rome. Romagna was formally annexed to the Papal States by Julius II. After the division of the country into legations the term Romagna continued in use, being applied more especially to the eastern portion of the country near the Adriatic, between Rimini and Ravenna, and not including Bologna or Ferrara.

ROMAN ARCHITECTURE. • Roman architecture was originally borrowed from the Etruscans—a people who migrated from Asia Minor and settled in Italy twelve or thirteen centuries before Christ—and from the Hellenic colonists of Magna Græcia. Rome was situated between the two, and her earlier architecture naturally partakes of the

characteristics of both. From the Etruscans the Romans derived a peculiar form of circular temple unknown to the Greeks, which long afterwards received its grandest development in the Pantheon; and also the circular arch, which they used with great skill and boldness, and constantly employed in all their secular buildings; while from the Hellenic races of Lower Italy they borrowed the rectangular peristylar temple, with its columns and horizontal architraves.

Roman architecture is characterized by a thorough appreciation of the powerful effects produced by size and mass, by great structural excellence, by variety of style and ornament, and by a general air of grandeur not infrequently tinged with vulgarity; but we never find in it the simplicity, harmony, and intellectual beauty which distinguish the finest buildings of the best era of Greek art. Yet, on the other hand, we see architecture applied to a far greater number of purposes than had ever before been attempted—not merely to tombs, temples, theatres, and amphitheatres, but also to baths, palaces, basilicas, triumphal arches and pillars, pontals, bridges and aqueducts. In their management of the "orders," which they derived from the Greeks, and which they applied to most of their buildings, the Romans were not equal to their masters, except in the single case of the Corinthian, which they seem to have duly appreciated and valued, and which they treated with much freedom and artistic feeling. But the meaning of Greek design was a sealed book to the practical unesthetic Romans. They had brought to perfection an architectural feature unknown to the Greeks, the arch; and they knew no better than to frame the arch with columns and entablature (see Arch of Constantine, Plate IV.), this frame, and not the real structure, taking the eye. As a result, the columns, serving no purpose, soon became engaged with the wall, and shrank into pilasters, while the noble entablature dwindled to a string course. The Roman Doric was far inferior to its Greek prototype [see PLATES GREEK ARCHITECTURE] in symmetry and grandeur. The shaft was longer and feebler, there was a distinct necking below the capital, and an independent base to the column. But one effect of these alterations, especially of the last, was that the order was rendered capable of combination with the other orders, whereas the pure Greek Doric refuses to submit to such combination. The Romans, so their own architectural historian, Vitruvius, says, invented two new orders—one, the Tuscan, based on the Doric; the other, the Composite, made of the Ionic and Corinthian. Of this last there are plenty of examples, as will be seen; but of the first there are very few. It is shown with Vitruvius' proportions in Plate I., fig. 4, and in a later style, at full length, in Plate III., where a section of the characteristic cornice is also given. Vitruvius says the height of the whole column, including base and capital, should be seven times the diameter, base and capital together being one diameter high, and that the upper diameter should be three-fourths of the lower diameter. The cornice should project, according to Vitruvius, one quarter the length of the shaft—an apparently extraordinary statement. No example exists to corroborate it, but the sentence is perfectly clear, and admits of no doubt. The shaft is quite smooth on the surface. The Romans appear neither to have understood nor liked the Ionic style (Plate I., figs. 5, 6, 7), and their modifications of it were the reverse of happy. The barbarous corner-wise arrangement of the volutes, shown in Plate II., exceedingly ugly as it is, was peculiarly in favour with the Romans. They retained the Greek height of nine diameters of the shaft. It is the Corinthian order only (Plate II., figs. 1–5) which the Romans appreciated and improved, giving to this latest and richest of the Greek styles a degree of fulness, strength, and beauty not since surpassed. The portico of the Pantheon (see Plate V.) and the Temple of Jupiter Stator afford admirable examples of their successful employment

of this order. The so-called Composite order (Plates II. and III.), in which the Romans endeavoured to combine the somewhat incongruous parts of the Ionic and Corinthian capitals, was not a happy conception, and it deserves rather to be considered as one of the many varieties of the Corinthian order, than as a distinct and separate style. As a specimen of it we may mention the Arch of Titus at Rome. Perhaps equal to the degradation of the column by using it as a mere decorative frame to the arch which was doing all the real work, was that favourite practice of the Romans, of perching columns upon pedestals, as in the ugly Tuscan column shown on Plate III. A comparison of this debased form with the pure Greek columns shown in our Plates on Greek Architecture, will show the hopeless wrongheadedness in matters of art of the Romans. They found the noblest feature in architecture ready made to their hands, and seem to have thought of nothing but altering it.

The temples of Rome were not so important a feature in her architecture as they were in that of Greece. Perhaps the most perfect specimen of a Roman temple now remaining to us is the so-called *Maison Carrée* at Nîmes. This temple is only 85 feet by 45; but its proportions are so just, and its details so elegant, that it impresses every beholder with admiration. The grandest temples of the imperial era were erected, not in Rome, but in the provinces. The first was that of Jupiter Olympius at Athens, completed by the Emperor Hadrian. It was 354 feet in length and 171 in breadth, and was adorned with 120 columns 58 feet in height, of the most elegant Corinthian style. The other was the noble temple group at Baulbec in Syria, of which the great temple measured 290 feet by 160, and the lesser 227 by 117. Six colossal columns—majestic even in decay—measuring 58 feet in height and 22 in circumference, are still standing to attest the original magnificence of these splendid temples.

Eloquence and the affairs of government and justice, as well as the exciting and barbarous sports of the arena, were more thought of and valued in Rome than religion; and hence her basilicas and amphitheatres were far more spacious and magnificent than her temples. See *BASILICA* and *AMPHITHEATRE*.

There are still the ruins, in a sufficiently perfect state to show us what the originals once were, of what we know to have been two of the most splendid basilicas in Rome—the Ulpian Basilica, built by Trajan, which had a wooden roof; and the Basilica of Maxentius (commonly called the Basilica of Constantine), which was vaulted over. The former was 180 feet wide, and about double that in length. The Flavian Amphitheatre or *Colosseum* (see Plate V.) is the most stupendous relic of imperial grandeur.

The theatres of the Romans much resembled those of the Greeks, but with the important difference that the senators occupied the space left empty as the orchestra in the Greek structure. Also the floor sloped upwards instead of being flat. Then followed the rows of the knights (Lat. *equites*), and then other divisions, the marks defining which may yet be traced at the fine ruin of Orange in France, and at the top the common people sat. The plan of a Greek theatre is given in *GREEK ARCHITECTURE*. Fine specimens are extant at Pompeii, Herculaneum, but of the scanty remains of the theatre of Marcellus little more than the exterior is to be seen; and the still more imperfect traces of that of Pompey are all that are left at Rome itself to tell of former glories. A column from the theatre of Marcellus is shown in Plate I., fig. 1. Akin to theatres and amphitheatres were the great buildings for races, bearing the name of circus, because the racecourse was around (Lat. *circum*) the *spina* or backbone of the arena. The plan of the Roman circus on Plate IV. shows the six *carceres* or starting-boxes, to the right of the middle entrance, whence the chariots started for the chariot-race; the six similar open-

ings on the left of the middle entrance were to receive them at the close of the race. They all entered the arena by the middle gate; and over this entrance sat the magistrates of the city, consuls, &c. (whence the name Gate of the Magistrates), as well as the giver of the spectacle, who started the race by dropping a napkin. The course was seven times round the *spina* (this was a wall 4 feet high), the laps being marked as they were passed by eggs placed upon seven small pillars on the *spina*, near the *meta* (or goal). The *spina* is observed to be nearer the *porta triumphalis* than the *carceres*, and in most circuses it is nearer the imperial gallery than the opposite side (36 feet nearer in Caracalla's great circus), because more room is required at starting, when the chariots are likely to run abreast. The *spina* was always kept to the left hand in running, and of course the drivers turned as close to the *meta* as possible. The victor made his exit by the *porta triumphalis*, having ascended the *spina* to receive his prize in full view of all the spectators. The seats of these latter were on the slope of steps, from the inner wall of the circus to the outer, in the fashion of an amphitheatre.

The *Thermae* or baths of Rome, and the characteristic Roman triumphal arches (see Plate IV.), memorial columns, and tombs, are spoken of fully in the article *Rome (Remains of the Ancient City)*.

And lastly, the long lines of aqueducts still stretching across the Campagna (see Plate AQUEDUCTS), the Pont du Gard at Nîmes (see Plate IV.), the aqueducts of Segovia and Tarragona, 100 feet high, and Trajan's bridge at Alcantara, in Spain, 180 feet high, remain striking proofs of the architectural skill and engineering ability of the Roman builders. The boldness of the design, the solidity of the execution, and the uses to which they were subservient, rank the aqueducts and bridges among the noblest monuments of Roman genius.

The palace which the Emperor Diocletian constructed at Spalatro, after his retirement from the cares of empire, is still sufficiently perfect, even in ruins, to give us some idea of the grandeur of domestic architecture among the wealthy Romans. It was but the country villa of a retired emperor, yet it covered $9\frac{1}{2}$ acres, or about as much as the famous palace of the Escorial in Spain. Herculaneum and Pompeii afford us an excellent idea of the style of houses of all classes in third-rate Roman cities, and the arrangement of the private houses in Rome was not materially different.

While the development of the arch is really due to the Romans, the popular idea credits them with a much greater use of that principle than they really attained. They worked in cement and concrete to an extent only now beginning to be appreciated, and a large number of what have been taken to be structural arches built into walls to take bearings, &c. ("relieving arches") are in truth little more than decorative in their character. Thus the familiar arches of thin tiles set edgewise all round the Pantheon at the back seem as if they were taking the pressure of the upper wall and roof; but this is seen to be absurd when it is observed that the wall is 20 feet thick in concrete, and the tiles forming the arches often run only 4 or 5 inches deep into the wall. The same remarks apply to the so-called vaulting of the basilica of Constantine, the Pantheon, &c., which were not vaultings at all in our sense of the word. That is to say, the principle of the arch or of the dome did not enter into them at all. The Romans, making use of their strong natural cement, the *pozzolana*, constructed concrete domes and vaults of enormous span, cast in one solid mass of concrete, which covered the space like a metal lid without lateral thrust, having, that is, the form, but not the principle of the arch. This allowed them to safely vault spaces so wide that the walls would have been pushed out if they had been covered with a true arched vault either in brick or stone.

Roman architecture, in fact, was largely modified by local conditions as to material. The hills of Rome are volcanic in origin, the dust and ashes and mud of prehistoric volcanoes having consolidated into a rock known as *tufa*, in many places soft enough to be dug out by the spade, but soon hardening with exposure, and making a fair ordinary building stone. The rock of the Palatine shows marks of various vegetable structures, and the fragments of the "wall of Romulus" give good examples of these impressions; evidently the eruption here fell upon a forest or jungle, which it charred and partly preserved. *Tufa* requires a coating of stucco, which later Romans always gave it, as will be presently shown, and in that case makes good solid walls fairly durable. Materials for building Rome thus existed actually on the spot. A better stone is the *peperino*, so called because the volcanic base contains fragments of black cinders "peppering" the stone all this conglomerate of cinders, ashes, gravel, &c., is found in the Alban Hills close to Rome. It is used in the Servian Wall, in the Cloaca Maxima, &c. Frequently, as in the Tabularium, a *tufa* core is faced with the harder *peperino*. The third great Roman building stone is a beautiful creamy limestone, the famous *travertine* ("lapis Tiburtinus") found at Tibur, near Rome, and in a coarser variety at Monte Parioli, just outside the gates. The exterior of the Colosseum derives its exquisite colour from its consisting of this stone.

But later Romans relied more on cements than stones for building; and here Rome was still more extraordinarily favoured. Large quantities of *pozzolana* (so called from the famous quarries at Puteoli, near Naples), a chocolate red volcanic earth, exist round and under Rome: mixed with lime and with broken lava (of which last a stream reaches along the Appian Way to within 3 miles of Rome, ending where the tomb of Cecilia Metella stands), it makes a wonderful cement, of the kind specially called *hydraulic*, from its power to set hard under water. Sand also abounded in Rome, on the Janiculum Hill—beautiful golden sand, which still gives its name to the well-known church of the "mount of gold" on the Janiculum, St. Pietro in Montorio. Brick earth is abundant along the Tiber valley.

All the greatest works, as regards size, in Roman architecture are built of *pozzolana* concrete with broken lava, stones, and lime. Huge walls, 100 feet high, of unfaced concrete, yet exist where Caligula's palace approached the edge of the Palatine; but generally the walls were faced. The concrete was poured into a wooden framing, as with ourselves, and then before it had set pyramidal bricks or blocks of stone were pushed in from the front, and the framework replaced till all was solid. The wall thus seemed to be of brick or stone, for the blocks fitted one another on the face. The faces were flat and square, and were usually arranged diamond-wise, not in horizontal lines. Between the bricks or stones thus thrust into the face of the concrete were driven metal pins, or sometimes marble plugs, and these were to give a firm hold for the facing of stucco, which nearly always gave the surface to Roman work. Even marble buildings (always in concrete cores, or nearly so) received a fine coat of stucco, so as to admit of painted decorations.

When Rome became undisputed mistress of the world she plundered the whole world to enrich her own buildings. The wealth of marbles and other rich stones lavished on Roman architecture, whether at Rome or elsewhere, cannot now be estimated. Raffaele complained to Pope Leo X. that all Rome in his day was built with mortar whose line was made by burning precious marbles. Every church and palace in modern Rome has treasures of the ancient magnificence. It is lamentable to think of the beauty thus wantonly sacrificed and lost for ever.

ROMAN CATHOLIC CHURCH, the name commonly used to designate the body of Christians in com-

munion with the Bishop of Rome. The society forming the diocese of Rome is properly called the Holy Roman Church. But as Rome is the centre of Catholic unity, the seat of him who is held by 200,000,000 Christians to be the vicar of Christ and the supreme shepherd of the flock, the denomination of "Roman Catholic Church" has been given to the great body of believers who acknowledge the authority of the Roman pontiff and deem communion with him to be essential. What first strikes the observer and the student of history in this great and widely extended society is—

I. **THE HIERARCHY.**—This comprises the body of the clergy in their various degrees of jurisdiction and ministration. The Council of Trent has declared it to be of divine institution, and composed of bishops, priests, and deacons or ministers (Session xxiii. c. iv., canon 6). As to the divine origin of the hierarchy, theologians refer to 1 Cor. xii. 5, "And there are diversities of ministries;" and 28, "And God indeed hath set some in the church, first apostles, secondly prophets, thirdly doctors;" Ephesians iv. 11, 12, "And he gave some apostles, and some prophets, and other some evangelists, and other some pastors and doctors, for the perfecting of the saints, for the work of the ministry, for the edifying of the body of Christ." The commission given by Christ to his apostles (St. Matt. xxviii. and St. Mark xvi.) to teach all nations, to baptize them, to make them observe all things whatsoever he had commanded, necessarily implied the power to perpetuate the spiritual authority conferred on them. "Behold I am with you all days, even to the consummation of the world." This power of ordination was exercised by the apostles and transmitted by them to their disciples and immediate successors: "For this cause I left thee in Crete, that thou shouldest set in order the things that are wanting, and shouldest ordain priests in every city, as I also appointed thee" (Titus i. 5). The historian Eusebius ("Ecclesiastical History," B. III., c. iv.) attests that "Titus was appointed bishop over all the churches of Crete." The mission intrusted to the apostles embraced the whole earth; their jurisdiction was not limited to one country or one province, although when, in the year of Christ 41–42, they agreed to disperse and preach the gospel beyond the limits of Palestine, each of them chose one particular portion of the known globe as the field of his labours. St. Peter, after having by his preaching and miracles laid the foundations of the church of Jerusalem, did the same in Antioch, the capital of Syria, where the denomination of "Christians" was first bestowed on his disciples. The same Eusebius bears witness to the fact, for he says that St. Ignatius Martyr was celebrated even in the beginning of the fourth century as the successor of St. Peter in the see of Antioch, and that Evodius, ordained by St. Peter, held the episcopal chair of Antioch immediately after that apostle ("Ecclesiastical History," iii., 22 and 36). St. Jerome adds to this, "We have received the tradition that Peter was the bishop of the church of Antioch, and then was translated to Rome" ("Comm. Epist. ad Galatas," c. ii.) Even during the lifetime of the apostles, and while they exercised the universal jurisdiction bestowed on them by Christ, that of the bishops established by them was limited to the city or district over which they had been appointed. The appellations of bishop (Gr. *epi*, over, and *skopeo*, to watch; Lat. *episcopus*; Fr. *evêque*, *evêque*, *evêque*, and *evêque*; Swedish and Danish *bishop*; Germ. *bischof*; Saxon *bischoep*) and priest (Gr. *presbyteros*, elder or ancient) soon obtained a very definite sense in the early Christian societies. Tertullian, explaining the Christian doctrines, practices, and discipline to the pagan Romans of the second century, says, "There preside over us certain approved elders (*probati seniores*), who have obtained the honour not by payment, but by the testimony of their merit" ("Apolog." c. 39).

At first the denomination of *presbyteroi*, or ancients, was applied to both priests and bishops. Thus St. Paul, addressing the presbyters of the church of Ephesus, said, "Take heed to yourselves and to the whole flock, wherein the Holy Ghost hath placed you bishops (Gr. *episkopous*), to rule the church of God, which he hath purchased with his own blood" (Acts xx. 17, 28). This confusion of terms was not, however, of long duration. Thus Tertullian says, "The right of conferring baptism belongs to the chief priest, who is the bishop, and after him to the priests and deacons, not, however, without the authorization of the bishop" ("De Baptismo," c. 17). The chief authority of the bishop in each city or diocese became more prominent as the numbers of each Christian society increased, so that St. Cyprian Martyr, writing about the year 250, says, "Hence you ought to know that the bishop is in the church, and the church in the bishop; and if any are not with the bishop, they are not in the church" ("Epist. 69 ad Florent"). As to deacons or ministers (Gr. *diakonoï*) their origin is marked out in the Acts of the Apostles. They were instituted to take care of the poor, the widows, and the orphans, leaving the twelve free to attend to the works of the apostleship. They were also soon employed in preaching, baptizing, and administering the Eucharist. Later inferior ministers were ordained as assistants to the deacons, and called sub-deacons. Subdeaconship is considered to be, like the priesthood and deaconship, a holy order.

Coming to the hierarchy of the Roman Catholic Church as it exists at present, the first in rank is the Pope, who is bishop of Rome, vicar of Christ, successor of St. Peter, the prince of the apostles, supreme pontiff of the universal church, patriarch of the west, primate of Italy, archbishop and metropolitan of the Roman province, and sovereign of the temporal dominions of the Holy Roman Church. The College of Cardinals of the Holy Roman Church ranks next to the Pope. The ecclesiastical denomination of "cardinal" or "chief" was bestowed in the earliest Christian times on the priests attached to the principal churches of Rome. Pope Evaristus, who held the see of Rome from the year 100 to 109, divided the city into parishes, appointing one priest to each, who ministered to the faithful in the lowly church edifice belonging to it. Pope Hyginus (139-42) increased the number of priests. But from that time the priest in charge or chief priest of each parish church was called cardinal-priest (*presbyter cardinalis*). The number of such cardinal priests went on increasing with the numbers of the faithful and those of the parish churches. The church in which the cardinal-priest ministered was called *titulus* (title). These, in the beginning and all through the time of persecution, were erected close by the cemeteries. The cardinal-deacons had a like origin. As in Jerusalem, so in Rome, the deacons had charge of the temporalities of their respective churches, and cared for the wants of the poor and sick. Pope St. Fabian (240) divided Rome into diaconal districts, which he called "regions," appointing for each deaconry a fixed place in which the poor should be ministered to. These were public hospitals, where the needy, the homeless, strangers, widows, and orphans found relief and a refuge. The deacons serving them and the clerics attached to them were called "regionaries." When the labours of one deacon no longer sufficed in his deaconry, assistant deacons were appointed, but the chief deacon in each district continued to be called the cardinal-deacon or chief deacon.

In the course of time, and after the era of Constantine, the diaconal chapels became churches or "titles." The cardinal-priests and cardinal-deacons thus acquired a natural prominence in the Roman Church with each successive age. In a council held in Rome in 769 Pope Stephen IV. decreed that no person should be eligible to the pontificate unless he had been previously promoted to

Alexander II. inclusive (died 1073), only six were of cardinal rank when they were elected. The forty-six popes who reigned from 1073 till 1389 were all, save eight, members of the Sacred College. At present it is the rule that no one but a cardinal shall be elected to the pontifical office. The Sacred College itself, as now constituted, consists of seventy members; but this number is never complete.

The cardinals themselves are distinguished into three orders, six of them being cardinal-bishops (holding the "suburbicarian" sees of Ostia and Velletri, Porto and Santa Rufina, Albano, Frascati, Palestrina, and Sabina), fifty cardinal-priests (a majority of whom are archbishops or bishops occupying sees in Italy and various countries of both hemispheres), and sixteen cardinal-deacons—each member of the two last orders being possessed of one of the presbyteral or diaconal churches of Rome, in conformity with the venerable custom explained above. After the cardinals come the patriarchs of Constantinople, Alexandria, Antioch, Jerusalem, Babylon, Cilicia, Lisbon, and Venice; then there are 153 archiepiscopal and 665 episcopal residential sees of the Latin rite, with twenty-four residential metropolitan sees and fifty-one suffragan sees of the Oriental rite. There are, besides, 131 titular archiepiscopal and episcopal sees of ancient churches, which the Congregation de Propaganda Fide confers on the most distinguished of the men whom it sends into the missionary field in various countries. Of these seven are delegates-apostolic, 123 are vicars-apostolic, and four are prefects-apostolic. In addition to these there are 188 archbishops and bishops of titular sees, of whom thirty-three are coadjutor bishops with right of succession, and forty are auxiliary bishops without any such right; five are apostolic nuncios; two are internuncios; and four are delegates-apostolic and envoys-extraordinary. Others hold important offices in the government of the church or in the papal court; and some are rewarded with episcopal rank for distinguished merit. Twenty-two prelates, several of whom are cardinals, have episcopal rank without title—like Cardinal Parocchi, at present vicar to Leo XIII., and formerly archbishop of Bologna; Cardinal Simeoni, prefect of the Propaganda, formerly archbishop of Chalcidon; and Cardinal Jacobini, secretary of state, formerly archbishop of Thessalonica. Counting all together there were, at the beginning of 1886, nearly 1200 members of the hierarchy.

The geographical distribution of these residential sees is as follows:—In Europe, ninety-three archiepiscopal and 488 suffragan sees; in Asia, three metropolitans and six suffragans; in Africa, two archbishops and two bishops, not subject to European metropolitans, besides nine sees subject to metropolitans in Europe; in America, thirty-three metropolitan and 154 suffragan sees, two of the latter (Guadeloupe and Martinique) being subject to Bordeaux; in Australia there are two archbishops and twelve bishops; the Philippine Islands form an ecclesiastical province with an archbishop and four suffragans; and in New Zealand there are three sees immediately subject to that of Rome. The residential sees of the Oriental rite are thus distributed:—The Græco-Romanian, in Austria-Hungary, with one archbishop and three suffragans; the Græco-Ruthenian has also in Austria-Hungary one metropolitan with one suffragan see, and three other bishops, one of whom is subject to the Latin archbishop of Agram, and the two others to the Latin archbishop of Gran. Three other bishops of the same rite are in Russian Poland, the Bishop of Minsk being subject to the Archbishop of Mohilef, and the Bishop of Chelm-Belz, with the Bishop of Supraslia, being immediately dependent on the

holy see. The Græco-Bulgarians have an archbishop who is vicar-apostolic for Constantinople and its district, and two bishops, vicars-apostolic respectively in Thrace and Macedonia. The Græco-Melchites have a patriarch in Antioch, with eight bishops. The Armenians have an archbishop at Lemberg, in Austria-Hungary, a patriarch of Cilicia of the Armenians residing in Constantinople, the archbishops of Aleppo and Mardin, and seven bishops of various dioceses in Asiatic Turkey, and one at Alexandria. The Syrian rite embraces one patriarch (Antioch), four archbishops, and eight bishops of the Syrian rite proper, a patriarch (Babylon), four archbishops, and six bishops of the Syro-Chaldaic rite; a Maronite patriarch of Antioch, with six archbishops and three bishops of the Syro-Maronite rite. The Syrian rite proper prevails in Egypt, Syria, and Turkish Armenia. The language used in the liturgy is the ancient Syrian, the same spoken by our Lord and his disciples. The Syro-Chaldaic rite is followed in Kurdistan, Turkish Armenia, Mesopotamia, and Persia; the liturgical language is the ancient Chaldaic. The Syro-Maronite rite prevails exclusively in Syria and the provinces of Asiatic Turkey, as well as in the island of Cyprus. The patriarch resides at Coenobin on Mount Lebanon. The liturgical language is the ancient Syrian. The Coptic rite is divided into two families, the Copto-Egyptian and Copto-Ethiopic or Abyssinian. The orthodox Copto-Egyptians are governed by a vicar apostolic, as were the Copto-Ethiopians. The liturgical language of the latter is the ancient Ethiopic, which is much like the Hebrew. With regard to the law of celibacy among the clergy of the Oriental rites, the customs of the East have obtained from the holy see a modification which does not exist elsewhere. It is permitted to such members of the clergy as are below the rank of subdeacon, that is, who are not in holy orders, to marry. When these are advanced to the superior degrees, they are allowed to retain their wives. Should they lose their wives, they cannot marry again. No one in holy orders is, therefore, ever allowed to marry. Married priests are never advanced to higher dignities. The reigning pontiff, Leo XIII., has done much to conciliate and win back the schismatical Orientals, and to promote education and the establishment of schools of every grade in favour of these peoples.

We now carefully follow Leo XIII. himself in the following doctrinal exposition.

II. ORIGIN AND PURPOSE.—The church claims to exist in virtue of that law of nature which destines and fits human beings, not only for domestic and civil society, but for religious society as well. "This union of man with his fellow-men in acknowledging, honoring, and worshipping God as the author of his being, affords him an easier and surer means of attaining the end of his creation and his perfect felicity. The outward and public manifestations of these sentiments, as embodied in the religious observances of all civilized peoples, bear witness to this law of nature; the sense of the obligation it imposes is visible even in the altars, the temples, the rites and celebrations, the sacrifices and priestly hierarchies of even uncivilized tribes. Inasmuch, however, as human reason, abandoned to its own native lights, did not teach mankind how to render the Deity a worship worthy of his holiness and greatness, nor suffice to bind the minds and wills of men together for the purposes of natural religion, the Creator came, by revelation, to the aid of his intelligent and erring creatures. For, "this was the occasion of deceiving human life: men, serving either their affection or their kings, gave the incommunicable names to stones and wood. And it was not enough for them to err about the knowledge of God, but whereas they lived in a great war of ignorance, they call so many and so great evils peace" (Wisdom of Solomon, xiv. 21, 22). The law promulgated on Sinai, and the alliance there made with the

chosen people, were only a prelude to the recalling of the entire human race to revealed religion. The Hebrew prophets had repeatedly foretold that in the fulness of time a Lawgiver would appear to perfect the work begun by Moses, and to unite all nations in worshipping the true God by the profession of one religious faith and the observance of one law of spiritual perfection and grace. Thus David announced that "all the ends of the earth shall remember and shall be converted to the Lord; and all the kindreds of the Gentiles shall adore in his sight. For the kingdom is the Lord's, and he shall have dominion over the nations" (Ps. cxvii. 27, 28); and (Ps. lxxxvi. 9), "All the nations thou hast made shall come and adore before thee, O Lord; and they shall glorify thy name."

In fulfilment of these prophecies the Son of God descended upon earth, became man, conversed with men, taught them by word and example, labored and suffered for them. He consummated on the cross the pact of reconciliation between heaven and earth, and, having broken the yoke of idolatry and sin, he founded the kingdom of God announced by the prophets, the spiritual coming together of the entire race of man in the bosom of one religion. Thereby he made provision for the needs and infirmities of our fallen nature, defining the uniform and perfect worship to be paid to the Godhead, and marking out for man the road to the attainment of the true and supreme Good, toward which his nature is invincibly drawn. In his overflowing kindness for the race he was pleased to elevate us to such a state of grace, to adorn our nature with such gifts, and to set us forward on the plane of so sublime a destiny that man in his original righteousness could never have aspired to such heights. To unite in one religion, in one faith, the minds of men, so divided by differences of opinion, he gave to all the great code of revelation in his Gospel. To unite all wills in one and the same love, divided as they are by opposite and conflicting affections, he became himself the living model of brotherly union and charity, making himself an expiatory victim for the sins of all, and making every human being a sharer in the fruits of his redemption.

To this great association every nation, every people without exception, was called. For, just as all men are, by the law of nature, subjected to the same religious duties and obligations, even so, in the order of grace, all men were purchased by the same blood, and raised to the same adoption through the merits of the same Redeemer. Hence they were destined to form under the same God and Father one perfectly ordered society, one single family: . . . The mystery of Christ, which in other generations was not known to the sons of men as it is now revealed to his holy apostles and prophets in the Spirit, that the Gentiles should be fellow-heirs and of the same body and copartners of his promise to Christ Jesus by the Gospel, of which I am made a minister according to the gift of the grace of God, which is given to me according to the operation of his power. To me, the least of all the saints, is given this grace to preach among the Gentiles the unsearchable riches of Christ, and to enlighten all men, that they may see what is the dispensation of the mystery which hath been hidden from eternity in God, who created all things; that the manifold wisdom of God may be made known to the principalities and powers in the heavenly places through the church" (Eph. iii. 5-10). The calling of the Gentiles to the unity of faith, and the possession of one divine inheritance by affiliation with the church founded by Christ, was the great object of his designs and care while on earth. Of this he made frequent mention in his instructions, explaining it to his disciples and to the multitude by means of the parables and figures best suited to his purpose. He spoke of it as "the kingdom of God," which was to obtain universal dominion, and which was to know no end; as "a house" so solidly built

that nothing should overthrow it; as "a ship," which the waves could not submerge; as "a net," gathering all manner of fish; as "a nuptial feast," in which every invited guest should find a seat; as "a sheepfold," into which all the lost sheep should enter. And although the end for which this supernatural institution was founded is to restore and elevate the relations between man and his creator, and to direct man towards the attainment of supreme felicity in the life to come, it is, nevertheless, certain that mankind, both in the temporal order and in the relations of social life, derive from the church innumerable and priceless benefits.

III. CONSTITUTION AND ORGANIZATION OF CHURCH.
—The church has the form of a true society; it possesses all the constituent elements, all the qualities characteristic of a society. It is a union of rational beings; it has a common and well-defined purpose; it is possessed of the means best fitted for attaining the end in view; it has an authority which directs and controls the actions of its members. These members, called to compose it, are the entire race of man. Baptism initiates them and grafts them on the body which bestows on them the benefits of redemption and social communion with those regenerated in the blood of Christ. The object in view is the imparting of all knowledge pertaining to the eternal salvation and the sanctification of souls, and the securing of a blessed immortality. "But now being made free from sin, and become servants to God, you have your fruit unto sanctification, and the end life everlasting" (Rom. vi. 22). This is identical with Christ's own purpose in coming down upon earth and accomplishing the work of our redemption. "I am come that they may have life, and may have it more abundantly" (St. John x. 10); "God sent not his Son into the world to judge the world, but that the world may be saved by him" (John iii. 17). The means toward that end are, the preaching of the gospel, faith, charity, the supernatural aids needful to fulfil the law and to overcome the soul's enemies, especially the sacraments, which are the channels of Christ's saving grace: "Now there are diversities of graces, but the same Spirit; and there are diversities of ministries, but the same Lord. . . . For in one Spirit were we all baptized into one body; and in one Spirit we have all been made to drink" (1 Cor. xii. 4, 5, 13).

Authority, which orders and disposes all the means for the destined end, and guides the entire community and every one of its members toward the attainment of that end, is, in the church, the priesthood, which works in the name and with the power of the divine Founder and eternal High Priest, Christ Jesus: "As the Father hath sent me, I also send you. When he had said this, he breathed on them and he said to them, Receive ye the Holy Ghost" (St. John xx. 21-22). This directing authority bestowed on the priesthood, in so far as it regulates and dispenses the means of sanctification and eternal salvation, has for its mission to operate and administer the sacraments and the other divinely ordained aids to supernatural life, in so far as it instructs and directs towards the supernatural end in view it is commissioned to rule and govern. Hence arises a twofold and distinct power, that of "order" and that of "jurisdiction." Christ clothed with the first the apostles and their successors, when he empowered them to regenerate the nations in the salutary waters of baptism (St. Mat. xviii. 19); to offer the spotless sacrifice of his body and blood (St. Luke xxii. 19); to reconcile sinners with God by absolving them from their offences (St. John xx. 23; St. Mat. xviii. 18). He clothed them with the second when he sent them to the whole race as preachers of his gospel, intrusted with the same mission, and invested with the same powers that he had received from the Father (St. John xx. 21), confiding to them the authority to teach, to feed the flock, to loose and to bind, to exact from all the same obedience which was due to himself:

"He that heareth you, heareth me; he that despiseth you, despiseth me. And he that despiseth me, despiseth him that sent me" (St. Luke x. 16).

In bestowing on his priesthood the power of order for the proper administration of the sacraments, he willed that those who were to be clothed with it should participate of it in various degrees. The power in its fulness resides in the episcopal body, from whom it is derived through the Holy Ghost to the priests and the inferior ministers, all forming together a threefold hierarchy (Council of Trent, session xxiii. can. 6), and all destined by their divine calling to co-operate more or less immediately in the celebration of the visible sacrifice, and in the dispensing of the divine mysteries. This multiplicity begets no confusion, since the various degrees are only the unfolding of one principle, the subordination of one degree to another, each with well-defined functions and distinct powers.

The same is to be remarked in the other sphere of power, that of jurisdiction. Without a centre of unity, without a supreme judge and moderator, it would be impossible to obtain or to preserve either oneness of belief or oneness of government. This was why Christ, while commissioning all his apostles to preach the gospel to the nations, bestowed on Peter alone the power to feed both lambs and sheep, both the nations and their pastors (St. John xxi. 16, 17). To him alone he gave the keys of the kingdom of heaven, and Peter alone was declared to be the foundation stone of the entire church, the supreme pastor of the whole flock (St. Mat. xvi. 18, 19). This pre-eminent power, established for the common good and the lasting good government of the whole Christian commonwealth, passed from Peter to his successors in the Roman pontificate; while, on the other hand, the charge of sharing in the pastoral mission and care of Peter passed from the apostles to the bishops, who succeed to them in the government of their respective churches (Acts xx. 28). This division of jurisdiction is in no wise detrimental to the unity of the Christian society. For while the bishops possess the rank of true pastors, and govern the flocks confided to them by divine appointment and their proper right, they remain nevertheless united with and subordinate to the supreme pontiff, as the minor planets depend on the central orb. They are pastors of distinct and particular flocks, over which they are placed by the First Pastor, to whom, in the person of Peter, Christ confided the government of the whole flock. The unity of the particular churches results from the union of the faithful of every country and diocese with their proper pastor; and that of the universal church rests, as on its pivotal point and centre, on the supreme pontiff, towards whom converge and on whom depend the individual flocks united with their respective pastors. So is formed one compact universal society of all the faithful, one single body held firmly together, wonderfully organized by mutual bonds of connection and hierarchical degrees, its invisible head and author being Christ himself (Eph. i. 22).

Considered with regard to the end in view, the church is a spiritual association, aiming to secure the sanctification and eternal salvation of souls. But it has also a material and visible part, consisting of human beings, who are made up of body and soul. And just as the redeeming mission of the incarnate God, although directed towards the expiation of sin and the salvation of souls, assumed nevertheless the sensible forms of the incarnation, of preaching in public, of sensible suffering, a visible death and resurrection, even so did he wish to clothe with material and sensible forms the acts of his religion and the ordinary means of sanctification—worship, teaching, sacraments. Wherefore there is, in the Christian society, a spiritual part which is called "the soul" of the church, and this it is which vivifies, informs, and rules all the members of the

mystical body, placing them in communication with their divine head and with each other, and effecting that blessed exchange of merits and riches called the communion of saints, and embracing all the just and the friends of God, and not only those who are still pilgrims on earth, but those as well who have reached the goal in heaven, or who are detained awhile in the purifying sufferings of purgatory. To the soul of the church belongs all that she has of interior and spiritual—faith, charity, hope, the gifts of grace, the fruits of the Holy Spirit, and all those heavenly treasures which come to her from the merits of the Redeemer and his holy servants. The other part constitutes, as it were, the body of the church, and is formed out of the visible and external elements derived either from its living members, or from its worship and teaching ministry, or from its outward order and government. As to the manner in which both these essential parts in the church are inseparably connected, as are the body and soul in man, so between member and member charity should establish such harmony and such mutual interchange of good offices, that the union shall closely resemble the physical unity of individual man. This is just what the apostle describes by the words, "Doing the truth in charity, we may in all things grow up in him who is the head, even Christ, from whom the whole body, being compacted and fitly joined together, by what every joint supplieth, according to the operation in the measure of every part, maketh increase of the body unto the edifying of itself in charity" (Eph. iv. 15, 16). Wherefore, to be in very deed a part of the church of Christ, and to share as an active member in its interior life, mere external aggregation does not suffice; it is requisite, besides, to be possessed of sanctifying grace, to be adorned with the principal virtues which bind man to God, such as faith, hope, and charity, and the practice toward one's fellow-members in the mystic body of meritorious good works. Hence the words of St. Augustine:—"These things are said to make us love unity and dread separation. A Christian hath nothing so much to fear as to be separated from the body of Christ. For if one is separated from the body of Christ, one is no longer a member of his; if one is no longer a member, then one is not animated by his spirit. But, as the apostle saith, whoso hath not the spirit of Christ is not one of his" (Tract. xxvii. in Joann.).

Inasmuch as the church derives immediately from God her origin, her purpose, and her constitution, it follows that she is thereby supreme and independent of any human power, and that she cannot and ought not to be subject to the control or sway of man. The end for which she was instituted, the propagation of revealed truth, and the eternal salvation of mankind, raises her far above any other human association. She is by her nature distinct from all such, and should be opposed by none, dominated by none in the fulfilment of her divine mission, because temporal interests should be co-ordinated with those of eternity, not placed before or above them.

If the church is a universal society, a society divinely intended for uniting in the name of Christ the Redeemer all the branches and children of the human family in the profession of one religious creed, and the practice of one religious worship, it is evident that she cannot be circumscribed to one place or limited by time; that her existence is not merely incorporeal, spiritual, invisible; but that her existence and life must be visible and external on account of the members of which she is made up, and of the official and external relations inseparable from her existence and action. It is also evident that all who wish to partake of the benefits of redemption and secure the attainment of their everlasting destiny, must, once they have been enlightened as to the existence of the church, give in their adhesion to her, and profess in her bosom the only true religion, which by faith subjects the intellect to the God of

infinite truth, and by charity embrace in him the sovereign good.

If there exists by divine institution a unitive and directing authority, and if this resides in the priestly order, one must acknowledge in the church a distinction of classes, offices, and powers; one must confess that there is in her superiors and subjects, pastors and a flock, persons authorized to teach and persons bound to hear this teaching (1 Cor. xii. 28, 29). We must conclude that to this authority it belongs to make laws in conformity with the end for which it was instituted, laws aiming at the common good of the religious society and its members, together with the power to enforce the observance of these laws by suitable sanctions (St. Matt. xviii. 17). We must also conclude that the exercise of this legislative power belongs to the hierarchical body to whom Christ gave the authority to command, just as to the same body, and not to any others of the social members, nor to the entire society, he committed the authority to govern, to teach the church, and to transmit by the sacrament of holy orders the priestly dignity in perpetual succession from generation to generation (St. Matt. xxviii. 18-20).

In this church so constituted theologians point out certain "properties" which flow from her very essence, certain "notes" or external characters by which the church is differentiated and distinguished from any other body; and, finally, certain supernatural "gifts" by which her divine founder wished to adorn her.

IV. PROPERTIES.—The first is "unity." We have just seen that Christ established a close and vigorous union, not only between the essential parts of the church, the body and the soul, but between the members themselves, in such a manner that this society should closely resemble a living individual man (1 Cor. xii. 20). This intimate and solid union could not exist without unity of faith, of communion, and of government. If the nature of a perfect society demands in its members union of minds in the knowledge and profession of the same truths, union of wills in the pursuit of a common end and in the exercise of common mutual love, one must easily see that the church ought to be, and that she is in fact, one by the perfect unity of faith and of communion. Therefore St. Paul said: "Fulfill ye my joy, that you be of one mind, having the same charity, being of one accord, agreeing in one sentiment" (Phil. ii. 2).

But this unanimous accord of sentiments and wills can only be obtained through an authoritative and unifying principle, which superintends and redresses to uniformity the external relations and actions of the whole social body. Hence the necessity of unity of government also, which is found strikingly exemplified in the submission of the various flocks to their respective pastors, in the communion of these pastors with each other, and in the subordination of all to the one Supreme Pastor (Eph. iv. 11). Moreover, Christ began by founding that immense society of believers in the person of his apostles, and through the agency of the preaching of the gospel committed to these. But in order that his doctrine, in passing from age to age, should ever maintain its purity and integrity, he perpetuated the teaching office, and willed that the apostleship of preaching should for ever continue through those who were legitimately ordained to succeed his apostles (St. Matt. xxviii. 19, 20). Hence St. Paul wrote to the Ephesians (ii. 19): "Now therefore you are no more strangers and foreigners, but you are . . . built upon the foundation of the apostles and prophets, Jesus Christ himself being the chief corner-stone."

The church must also be "apostolic," because she was firmly planted and widely propagated by the labours of the apostles and their successors, and because she faithfully observes and guards the faith and the doctrine received from them; and because she is in possession of the

legitimate succession of the Christian priesthood and of the divine commission to continue the apostleship of preaching.

The third property characteristic of the church is that of "catholicity." For she professes the true religion destined to secure the salvation of all men; she has in deposit all the truths revealed by Christ, with the perpetual obligation of guarding, diffusing, and preaching them. She has, therefore, been assigned a scope and a mission which are universal, which embrace all time, all places, all the tribes of the earth: "Go ye into the whole world and preach the gospel to every creature" (St. Mark xvi. 15). And, in fact, her zealous missionaries have borne the supernal light to every land under the heavens, and have succeeded in converting and civilizing the most barbarous and inhospitable peoples. There is no country so remote or little known to which she has not extended the benefits of her preaching and her spiritual sway. But besides winning over to divine truth those who dwell in the darkness of error, the church is also intrusted with the sublime office of bestowing her labour on the sanctification of her own children, placing within their reach the most timely and efficacious helps toward maintaining themselves steadily in the grace of God, toward regaining it when lost, and toward rendering themselves in every way worthy of their heavenly inheritance. Hence her fourth property, that of "holiness." She is truly holy, not only with respect to her sanctifying mission, but holy in so far as, being the mystical body of Christ, she lives by his life, adorned with his supernatural virtues, and embellished by the transcendent gifts of the Holy Spirit. She is holy in her ministry, in her hierarchy, and in all the means divinely ordained for attaining her end, which is of all ends the most noble as well as the most holy.

V. THE NOTES OF THE CHURCH.—The knowledge of the essential properties of the church enables one readily to discern the external characteristics by which the true church of Christ is distinguished. Since she has been founded by the Redeemer for the purpose of saving all men, she must have certain marks by which all men may know her; these are called "notes." These are nothing more than the external manifestation of her essential properties, which we have been just describing, as they reveal themselves clearly and readily to the eye of the attentive observer, and distinguish the church from any other religious aggregation. Her *unity*, for instance, is strikingly manifested in the outward profession of one and the same faith, in the communion of the faithful with each other and with their respective pastors, and in the subjection of the entire body to the Supreme Pastor, who is the centre of unity. Her "universality" is manifest in her uninterrupted existence and duration through the course of nineteen centuries, and by the diffusion of her doctrine and the extension of her members throughout the entire universe. Her "holiness," though intimately related to the invisible and interior gifts of grace, and the operation of the Holy Spirit in the souls of men, shines forth to the eye of him who considers the sanctity of the end the church has in view, the sanctity of the doctrines she professes, and that of the supernatural means employed by her under Christ's ordinance. Theologians moreover point with assurance to the great numbers of men and women of proven and extraordinary holiness, whose lives and virtues have glorified the Christian name in every age since the time of the apostles.

But these notes or characters of the church may be seen more clearly and grouped together by the attentive consideration of the single fact of the constant and legitimate succession of the priesthood. Peter was the corner-stone on which Christ built his church (Mat. xvi. 18), and the apostles were its foundation (Eph. ii. 19). Wherever, then, their lawful successors and heirs are found, there is the true church. For Christ ordained that with their

succession should be connected the unity of faith, of communion, of government, the authoritative preaching of the gospel, and its diffusion in all countries and among all nations. No other Christian society, no other confession, it is claimed, outside of the communion of the Roman Catholic Church, can pretend to and prove its apostolic origin, and the uninterrupted continuation of its apostolic commission through the progressive series of pontiffs and prelates, lawfully ordained, and invested with the same unifying and directing power, which was divinely bestowed on Peter and on the apostles. Hence the "notes" of the true church are focussed in that of the apostolic succession; *ubi Petrus*, says St. Ambrose, *ibi Ecclesia* (Quart. in Ps. xl. 30).

VI. QUALITIES OF THE CHURCH.—These are the superhuman prerogatives which are indispensable to the church for the full attainment of the end for which she was instituted. They are "indefectibility" in her essence, "perpetuity" in her existence, "infallibility" in her teaching. These are the dowry bequeathed to her by Christ her spouse, and the seal of the promised and un-failing assistance of his Spirit. To be indefectible means, for the church, the impossibility of ever changing her essence or constitution; it means that she must ever remain till the end of time identical with herself as Christ founded her. No power on earth or under God can destroy or corrupt this great work of his almighty power. This indestructibility is evident from the long story of the interior revolts and the external persecutions to which the church has been subject during the nineteen centuries of her existence. This divine prerogative secures her future triumph over every assault, over every enemy who may oppose the fulfilment of the mission confided to her. The church is perpetual in her duration, as are the fruits of redemption which she is charged to communicate to all generations. The angel who bore the first message of the coming redemption announced solemnly that Christ "shall reign in the house of Jacob for ever, and of his kingdom there shall be no end" (St. Luke i. 32, 33). From him the apostles afterwards received the assurance that he should be with them and their successors until the end of the world (St. Mat. xxviii. 20). This meant that his religion and the great family of his followers should last as long as the world. This perpetuity is in accordance with the Old Testament prophecies foretelling that the church of the new law should be a kingdom extending through all time, a reign that was to know no end: "A kingdom that shall never be destroyed, and his kingdom shall not be delivered up to another people; and itself shall stand for ever" (Dan. ii. 44). The church is infallible in her teaching. The mission given by Christ to his apostles and their successors, that is, to the church, to "teach all things whatsoever he had commanded" (St. Mat. xxviii. 20), absolutely implies that they cannot teach error instead of truth. For their teaching mission is that of Christ himself—that of God, who is truth itself. The church thus established and empowered to continue Christ's mission of teaching and saving, is called "the pillar and the ground of truth" (1 Tim. iii. 15). And with this teaching church the divine Spirit abides for ever: "And I will ask the Father, and he shall give you another paraclete, that he may abide with you for ever, the spirit of truth, whom the world cannot receive, because it seeth him not, nor knoweth him. But you shall know him, because he shall abide with you, and be in you" (St. John xiv. 16, 17). This prerogative of infallibility resides in the supreme head of the church as in its active subject, and in the body of pastors assembled ecumenically under this head. This body of pastors, although composed of individuals fallible in themselves and while acting separately, is nevertheless infallible when united with the successor of Peter, its head, and fulfilling the divine office of bearing witness to the revealed truth

and acting as its appointed guardians. Then they are assisted by the Holy Ghost. And both the supreme pontiff when teaching the entire flock the revealed doctrine and the rules of Christian life, and the episcopal body when doing the same conjointly with him, are infallible, that is, divinely protected from all error in the fulfilment of their teaching office.

VIII. DOCTRINES OF THE ROMAN CATHOLIC CHURCH.

—The Roman Catholic Church believes in one living, personal, and infinitely perfect God, the creator of the visible and invisible worlds, eternal, self-subsistent, distinct from and independent of his own creation; who governs all things, and so directs them that they necessarily tend to the glory of the Creator. In the one divine nature there are three infinite persons distinct from each other, Father, Son, and Holy Ghost. God in the beginning of time created the angelic world and the material universe. He afterwards created man, whom he raised to a supernatural rank, destined him after a period of trial to the glory of the beatific vision. Man fell, by voluntary transgression, from this divine elevation, forfeited the ornaments of grace belonging to this primeval condition, and the right to the supernatural heaven, by which his fidelity was to be rewarded. The Son of God, the Second Person of the Trinity, in order to save man, to restore him to his lost rank and heavenly inheritance, assumed human nature, was born of the Virgin Mary, through the operation of the Holy Ghost, the Creator Spirit; lived and laboured among men to teach them the law and the way of life, both by example and by precept; then consummated the work of their redemption by paying their ransom in his own body on the cross. His resurrection from the dead is

proof and the pledge of that of all flesh in the fulness of time; his ascension into heaven was the taking for them in his own name possession of the everlasting glory and immortal life promised to his faithful followers. Baptism is the initiatory rite by which man becomes a member of the church founded by Christ; the water, which is the matter of this sacrament of regeneration, typifying the blood of the only begotten Son, made man, by which the children of Adam become the adopted children of God. Infants baptized and dying in infancy receive the full benefit of Christ's atonement, and are admitted to the possession of the heavenly inheritance. Adults baptized in infancy must, when they have attained the age of reason, make good by their own voluntary and living faith and the virtues of a truly Christian life, the pledges given for them at the baptismal font, if they would have any part with Christ. Persons receiving baptism after attaining the age of reason must believe in the Redeemer, and have a true sorrow for their sins, if they would receive the grace of the sacrament. Christians falling away from baptismal grace have still, in the saving ordinances left by Christ with his church, the means of forgiveness and restoration to divine favour; but true interior repentance and genuine fruits of godliness are required of the sinner. The grace necessary to the beginning of justification, as well as to its growth and perfection, is derived from the infinite merits of Christ; every good work of ours available to salvation is rooted in his atoning blood, grows through its virtue, and in it blossoms and bears the fruit of life eternal. The penitential satisfaction demanded, in public or in private, of the sinner in the early ages of Christianity, as well as that which is imposed in our own day on the repentant sinner, derives its atoning efficacy from the same infinite merits of the Redeemer.

In this great society, formed of all believers in communion with the see of Rome, the supreme worship is paid to God alone. Every member of the church unites his adoration with that paid by Christ, as man and the Head of the whole body, to the infinite majesty of the Godhead. He is the mediator. His saints, who are the most glorious

members of that body, and who derive from him their holiness and power, offer through him their intercessions for their struggling brethren on earth. In the Catholic belief the Virgin Mary is looked upon as the second Eve, the mother of regenerated humanity, as Christ is the second Adam. She, however, is only a pure creature, while her son is very God. But her interest in all Christ's redeemed, as his mother and the parent of the new life, must ever be great, while the honour and reverence in which she is held by all the children of God are only such as are due to her dignity and her motherly relations toward humanity. The inferior religious honour paid to the mother of Christ and to his saints is only the homage due to God's resplendent gifts in them. Such also is the reverence or worship paid to the angels, who are his most excellent creatures, his most faithful servants, and the untiring benefactors of mankind. As to the reverence shown by the church to the crucifix, and to images and statues representing the saints, it is founded on the deep-rooted sentiment of rational nature, to which the sight of such representations recalls what is dearest to the heart and first in our respect and veneration. We know that the cold image of Christ crucified is not our living Redeemer, but it reminds us of his infinite love for us. And the uncovering of the head or the bending of the knee is not addressed to the inanimate wood or metal or stone, but to him who gave himself to death for us upon the tree. So is it with the respect paid to holy images; they recall God's glorified servants, remind us of their loving interest in our welfare, and of our duty to be, like them, generous followers of Christ. Relics, whether of the true cross or of the bodies of the martyrs or other saints, are venerated for a like

reason. The bodies of Christ's glorified servants were, in their lifetime, the temples of the Holy Ghost; they are destined to share in the glories of his resurrection and the bliss of his immortal life. We surround them, in consequence, with all manner of respect. As to any cures or miracles performed by their contact as attributed to them, these are due to the Creator, who condescends to use even the remains of his servants as life giving or healing instruments, as when the dead body of Elisha or Eliseus (2 Kings xvi. 24) instantly restored to life the corpse cast into his sepulchre. Such is the virtue attributed to even the shadow of the apostle Peter in the first days of the church (Acts v. 15).

As to the solemn acts of divine worship obligatory on all Christians, the first is the sacrifice of the mass or the Eucharistic celebration. Christ, the Roman Catholic Church teaches, in commanding the twelve to celebrate the rite fulfilled by him in the last supper (St. Luke xxii. 19, 20), instituted a rite commemorative of his passion and death. In it, according to the belief of the Western Church as well as of the Eastern Christians, is offered to God a true sacrifice, the victim being none other than the Lamb of God himself, whose body is really present under the element of bread, and whose blood is also present under that of wine, the separate consecration of these elements representing, in the separation of the blood from body, the death of the Lord. The obligation of being present at this divinest act of religion on Sundays and holidays of precept, is incumbent on the whole body of the faithful—the oblation of this great sacrifice by both priest and people being the highest means of hallowing such days and honouring the Deity by the unbloody renewal of the all-atoning sacrifice of Calvary.

The Eucharistic rite, which is thus at once both a sacrament and a sacrifice, is the centre of the sacramental system of the church, which consists of seven sacraments: baptism, confirmation, penance, Eucharist, extreme unction, order, and matrimony. These are instruments or means of grace instituted by Christ by which the divine or supernatural life is communicated to the soul and increased

therein. The external rite in each sacrament points to the nature and special effect of the grace attached by its divine author to its worthy fulfillment. Baptism is the gate of admission to the society of Christ's faithful followers; it bestows on the neophyte a new birth in Christ, gives him the rank of adopted child of God, and sets him on the plane of a divine destiny. Confirmation places the Christian in a more intimate relation with the Holy Spirit, who confers on the recipient special strength and generosity to confess the faith and withstand the assaults of its visible and invisible enemies.

Penance establishes a visible means by which the Christian who has fallen off in any degree from the innocence and holiness of his baptismal condition is restored to grace. Christ, in the person of his lawful ministers, sits in judgment on the guilty soul, who turns heartily away from her sinful ways, confesses her misdeeds, repents of them with a true and heaven-given sorrow, and undertakes to satisfy both God and man for the wrong done by past transgressions. It is repentant love humbling itself at the feet of Christ in the person of the priest, washing her stains anew in his blood, and beginning afresh a life of generosity and atonement. The sacrament of penance, in which the soul thus cleanses herself in the blood of the Lamb, is the ordinary preparation for receiving the Eucharist. The bread, which becomes by consecration the body of the Lord, is for the soul of the recipient the food of spiritual life. The Eucharist is also the bond of communion in charity and faith between all those who form the mystic body of Christ, as well as pledge of the eternal life in which Christ shall be all in all. Extreme unction is the sacrament of the dying, in which the unction given by the priest represents the interior grace of Christ anointing, consecrating, and purifying at the last hour the soul and body which had been in life the temple of the Holy Ghost; the imposition of hands and the prayer signify the operation of the creating and redeeming hand laid on the sick man to restore him to bodily health or to prepare him for the last judgment. The beautiful prayers of the ritual are the voice of the church pleading for the final triumph of her agonizing children over sin and the everlasting death.

Of the two last sacraments, order, by the imposition of hands, perpetuates the priesthood of the Christian church, as the sacrament of matrimony, administered and received as Christ wills it, perpetuates the race of the true children of God on earth. Both the one and the other demand in the recipients purity of soul. In the ministers of the sacraments, according to the universal and constant teaching of the church, we are to see only the divinely appointed agents of God's power. His grace, irrespective of their personal worthiness and merits, passes into our souls by the sacrament, when the minister has done, on his part, what Christ commands, and when we, on ours, do what he requires for the reception of the benefit he intends to bestow.

As to the economy of divine grace itself, the church teaches that inasmuch as the elevation of man in Christ to the supernatural rank of child of God, and the beatific vision, with its blissful and everlasting life, are things which transcend the conception of reason and the exigency of human nature, so all the means and helps co-ordinated towards our securing and attaining this destiny must needs be also supernatural. Grace—which is God's free gift to us to supplement our natural weakness and utter inability—is therefore in itself and in its manifold variety supernatural. God enlightens the mind in the first dawn of every salutary thought, strengthens and impels the will to follow the dawning light. In every action of divine grace there is the same harmonious help bestowed on both faculties; it is given to both simultaneously, and the strength given to the will to act is proportionate to the

light vouchsafed to the mind. But under the influence of the most powerful grace the will is left free to act. He who made the soul and gave it such wonderful faculties knows how to respect the innate freedom, which is the source of all our merit under his grace, and so to enlighten the intellect and to move the will that our freedom shall be intact in following and obeying his mightiest impulses. Even when human nature is most conscious of its weakness and inability, it is free to pray for the needful strength. The very thought of praying comes from the sovereign goodness; and the grace of prayer, if complied with, is followed by the grace of action. What is practically beyond our strength becomes actually possible, if not without difficulty, in the performance of our duty. The Holy Spirit, whose ever-ready assistance is secured to the soul which does not wilfully banish him by guilt or refuse his help, unfailingly prompts the faithful Christian toward all good aims and deeds. To him—to God—properly belongs the glory or the merit of our performances, because from him is our sufficiency. But he rewards the right use of our liberty and the generous co-operation with his grace. With regard to the reconciling of God's all-embracing foresight with the exercise of man's free will, the church permits theologians a wide field of discussion. The infinite prescience of the Deity and the inviolable freedom of the human will are facts which she allows no one to question. She acknowledges the awful obscurity which surrounds this matter, is contented to affirm solemnly the freedom of our actions under the impulse of divine grace, the absolute necessity of grace itself for all supernatural and meritorious acts; and even for the beginning of the same, she affirms that without the grace of Christ we can do nothing that is available to our salvation, and that we can do all things in him who is our strength. This supernatural and copious assistance is not bestowed on the elect alone. Christ died for all men, and it is the will of God that all men be saved. For this purpose he grants to all, either proximately or remotely, graces sufficient to secure their salvation. Being infinitely just and wise he cannot impose on his rational creatures obligations impossible to be discharged, or bind them to observe a moral law entirely above their strength to fulfil. But such difficulties as meet in human weakness in the observance of divine commandments, God's grace enables them to overcome; and he bids us all to pray, and pray unceasingly, that this needful grace may be granted us.

IX. THE LIFE TO COME.—God himself, beheld in his own essence, seen face to face, known perfectly and possessed everlastingly, is the reward promised by Christ to his faithful followers. The beatific vision is granted immediately after death to the faithful souls who depart this life free from all guilt and stain of sin. After the general resurrection the souls of the just, reunited to their bodies, shall possess the fulness of supernatural bliss. Souls departing this life free from the guilt of deadly sin, but stained by lighter guilt or otherwise debtors to the divine justice, must expiate and purge away the same before being admitted to the clear sight and possession of God. In heaven the degrees of glory and beatitude vary according to their respective merits. "as star differs from star in brightness." By voluntary mortal sin unrepented of at the hour of death, the soul incurs eternal punishment—that is, everlasting separation from God and from the blissful society of his angels and saints.

ROMAN CEMENT is a mortar capable of setting under water, and is manufactured by the calcination of limestone containing more than 10 per cent. of silica, or by igniting a mixture of ordinary lime and clay. It was originally made from the *PRIZZUOLANA* of Naples.

ROMAN EMPIRE, THE HOLY, the original title of what is commonly called the German Empire, lasting from Charles the Great (Charlemagne), crowned first emperor in 800, to Francis II., who abdicated, and re-

named his state the Empire of Austria in 1806. See **HOLY ROMAN EMPIRE**.

ROMAN LAW. The historical origin of the Roman law is unknown, and its fundamental principles, many of which are embodied in the legislation of Justinian, are older than the oldest records of Italian history. The foundation of the strict rules of the Roman law as to familia, agnatio, marriage, testaments, succession to intestates, and ownership was custom.

The earliest Roman legislation of which we have any remains is the compilation called the Twelve Tables. Their object was to confirm and define, perhaps, rather than to enlarge or alter, the Roman law, except in some few matters. The Twelve Tables were a body of constitutional law as well as other law, and dealt with public as well as private pleas. Ten tables were made public by the Decemviri or ten commissioners in B.C. 451, and in the following year two other tables were added. The rules contained in these tables long continued to be the foundation of Roman law, and they were never formally repealed. The brevity and obscurity of this ancient legislation rendered interpretation necessary; and both the interpretation of the laws and the framing of the proper forms of action belonged to the College of Pontifices. The civil law was thus inseparably connected with religious law (*Jus Pontificium*), and its interpretation and the knowledge of the forms of procedure were long the exclusive possession of the patricians.

In the republican period new laws (*leges*) were enacted both in the *Comitia Centuriata* and in the *Comitia Tributa*. The *leges* passed in the *Comitia Tributa* were properly called *Leges Tributæ* or *Plebiscita*, and originally they were merely proposals for a law which were confirmed by the curiæ. But the *Lex Publilia* (B.C. 336), and subsequently the *Lex Hortensia* (B.C. 286) gave to the *Plebiscita* the full force of *leges* without the consent of the patres, and a *plebiscitum* was accordingly sometimes called a *lex*. The *Senatus consulta* (decrees of the senate) also formed a source of law under the republic. It does not seem as if the Romans themselves had a very clear notion of the way in which the senate came to exercise the power of legislation; but they imagined that it arose of necessity with the increasing population of the state and the augmentation of public business.

A new source of law was supplied by the *Edicta* of those magistrates who had the *Jus Edicendi*, but mainly by the prætors—the prætor urbanus and the prætor peregrinus. The edicts of the prætor urbanus were the most important. A rough parallel may be drawn between the prætor's edict (which every successive prætor re-enacted and added to) and our unwritten or common law: the other great branch, being the statute or parliamentary law, corresponding with the Roman *leges* and *senatus-consulta*.

With the establishment of the imperial constitution begins a new epoch in the Roman law. The *leges* of Augustus and those of his predecessor had some influence on the *Jus Privatum*, though they did not affect the fundamental principles of the Roman law. A *Lex Julia*, better known as the *Lex Julia et Papia Poppæa*, had thus for its object the encouragement of marriage, but it contained a great variety of provisions.

The development of the Roman law in the imperial period was chiefly by the responsa and the writings of the Roman jurists. With the gradual separation of the *Jus Civile* and *Jus Pontificium*, owing to the political changes by which plebeians were put on a level with patricians, there arose a class of persons who are designated as *Jurisperiti*, *Juriconsulti*, *Prudentes*, and by other equivalent names. Tiberius Cornucanius, a plebeian, pontifex maximus, and consul B.C. 280, is said to have been the first who professed to expound the law to any person who

wanted his assistance; he left no writings, but many of his responsa were recorded.

The Emperor Augustus first gave to certain jurists the *respondendi jus*, and declared that they should give their responsa "ex ejus auctoritate." The jurisperites were not only authorized expounders of law, but they were most voluminous writers. The commentators on the Edict were also very numerous, and among them are the names of Pomponius, Gaius, Ulpian, and Paulus. Among the sources of law in the imperial period are also the Imperial Constitutions.

With the decline of Roman jurisprudence began the period of compilations or codes, as they were termed. The earliest were the *Codex Gregorianus* and *Codex Hermogenianus*, which are only known from fragments. Though these codes were mere private collections, they apparently came to be considered as authoritative, and the codes of Theodosius and Justinian were formed on their model.

The Code of Theodosius was compiled under the authority of Theodosius II. It was promulgated as law in the Byzantine Empire, 438; and in the same year it was confirmed as law in the Western Empire by Valentinian III. and the Roman senate. This code consists of sixteen books, the greater part of which, as well as of the *Novellæ*, subsequently promulgated by Theodosius II., are extant in their original form.

The subsequent codification and legislation of Justinian is treated of under **JUSTINIAN'S LEGISLATION**. A clever book by Mr. Scrutton, which gained the York prize at Cambridge in 1884, traces the "Influence of the Roman Law upon the Law of England" (London, 1886), a subject often attempted before, but never done so fairly and in so interesting and thorough a manner.

ROMAN NUMERALS. See **NUMERALS**.

ROMAN WALL. Two walls from sea to sea defended Roman Britain from the north. The chief was that constructed by Hadrian's orders about 120 A.D., and repaired by Severus about 210 A.D.; it was 80 miles long, and ran from the Solway to the Tyne. It had an earthen rampart and a stone wall, and the wall was 8 feet in breadth and 12 in height, according to the testimony of the Venerable Bede, in whose time it still stood. Of these the rampart was always formerly ascribed to Hadrian, and the stone wall to Severus; but latterly some antiquaries have thought there were reasons for attributing both to one work. Fragments still remain. See **SEVERUS**.

The other and far less important work was earlier, and marked the furthest point reached by the Roman arms, but not held for long with any settled hold. It began with a line of forts, erected from the estuary of the Forth to that of the Clyde, built by Agricola about the year 83 A.D., as a defence against the Caledonians. Sixty years later this was strengthened by a turf rampart, 36 miles long, known as the Wall of Antoninus. Traces can still be identified.

ROMANCE originally signified any composition in the **ROMANCE LANGUAGES**, dialects which superseded the Latin after the fall of the Western Empire, and as it was usual to write only amusing songs and legendary tales, &c., in these vulgar dialects, putting all serious work into Latin itself, the term Romance literature became synonymous with such productions. In course of time the name was applied to compositions, whether in verse or prose, in any language, which treated of marvellous or uncommon incidents, and the name has been retained to this day in several European languages to signify a fictitious narrative. The Italians and French call a novel *romanzo* and *roman* (masculine) respectively. But the French call an historical ballad *une romance* (feminine).

The oldest romances appear to have been legendary stories concerning Arthur and the Knights of the Round Table. The earliest romantic legends which have come down to us are of the twelfth century: Geoffrey of Monmouth's Latin

Chronicle of England; Turpin's Latin Chronicle in France; Wace's "Le Brut," a metrical romance concerning the fabulous history of England, in Norman French; "Le Roman du Rou," by the same writer, concerning Rollo and his successors; and "I Reali di Francia," in Italian prose.

The vast subject of romantic literature, in its general and more extended sense, may be divided into the following branches:—(1) Romantic ballads and traditional songs, which appear to be the oldest form, and to have existed among most nations in their primitive state. (2) The chivalrous fictions concerning the deeds of Arthur and the Peers of the Round Table. (3) The romances concerning the supposed wars of Charlemagne and his twelve paladins, especially those against the Saracens. (4) The Spanish and Portuguese stories of the fabulous exploits of Amadis de Gaul and Palmerin, &c. (5) The classic romances concerning Jason, Hercules, Alexander, those heroes having been transformed into knights of chivalry. (6) The epic romances of the Italians in the fifteenth and sixteenth centuries. [See FELIC; ARIOSTO.] (7) The spiritual or religious romances concerning the miracles of saints and the death of martyrs, such as the "Contes Devots" of the French, the "Golden Legend," &c. (8) The pastoral romance, which Cervantes ridiculed, and which afterwards gave rise in the seventeenth century to the interminable and dull romances of La Calprenède, Mademoiselle de Scudéry, and others. (9) The comic romances, which were written chiefly as parodies of the heroic and chivalrous fictions. Such were those of Rabelais, Cervantes, and Scarron. (10) The political romances, such as Telenoque, &c. (11) Lastly comes the modern *roman*, which forms a distinct species, as it does not deal in the marvellous and supernatural, but represents men conformably to the manners of the age in which they lived.

ROMANCE LANGUAGES is the name given to those modern languages which have immediately descended from the language of old Rome. These were the natural result of the Roman conquest of the civilized world. The conquered people were called by the general name of Romans, from whence came the name of the language, which was also called *lingua vulgaris*. In course of time, however, the conquerors adopted the Latinized language of the conquered, who, being more instructed, furnished most of the priests and scholars of the age. But the language (the *Lingua Romano*, or Provençal) thus adopted by both the conquering and conquered races, although essentially formed of Latin elements, differed according to the various localities and the greater or less degree of admixture of the northern native people with the Romans proper.

The gradual process by which the popular Latin, almost a distinct language from "literary Latin" [see articles LATIN LANGUAGE and FRENCH LANGUAGE], spoken in the provinces of Western and Southern Europe in the sixth, seventh, and eighth centuries was transformed into the Romance languages of the ninth and tenth centuries was first shown by Diez ("Grammatik der Romanischen Sprachen," three vols., Bonn, 1836-42), and is a study of absorbing interest.

After A.D. 1000, the Romance language of Italy may be considered as fully formed. In the thirteenth century it was in its decline, and the Italian or Tuscan rose upon its decay. When Dante appeared the decline had begun, and it was completed during the first part of the fourteenth century.

The Langue d'Oïl, or Northern French, having become the language of the court and of the capital, gradually encroached upon the Lengua d'Oc, as the provinces south of the Loire became incorporated with the monarchy (*oc* and *oïl* were the two forms of "yes"). The invention of printing favoured the extension of the former; and in the sixteenth century it was enacted that all public acts and deeds should be written in the Langue d'Oïl, or

the French, as it was called. The Lengua d'Oc was thus restricted to mere domestic purposes. It still exists as Provençal, with a southern (Spanish) form, Catalan.

The popular Latin of Spain gave rise to the Catalan, the old Portuguese or Galician, and the Castilian or modern Spanish. The last two, and especially the Castilian, received a considerable admixture of Arabic words, from which the Catalan remained comparatively free. The Castilian, notwithstanding the assertion of Bouterwek to the contrary, was not formed in the eleventh century. The oldest existing monument of Castilian, the poem of "El Cid," is not older than the year 1200. Previous to the twelfth century the Galician or old Portuguese appears to have prevailed in all Western Spain.

The dialects of Western Switzerland, Vaud, Neuchâtel, Geneva, part of Fribourg, and Lower Valais, and also of Savoy, have retained to this day the name of *Patois Romand*, or *Langue Romande*. Some of the dialects of Western Switzerland approximate in their inflections to the Northern French, or *Langue d'Oïl*, while others, like that of Gnyere in the canton of Fribourg, bear more affinity to the Romance of the south, and consequently to the Italian. To this day Switzerland is divided by languages, races, and habits into German and Romande, and the Germans call the latter by the general name of *Wälschland*.

In the country of the Grisons, or ancient Rheti, one-half of the people speak a language called *Rumonsch* (or *Romantsch*), which is an Italian dialect of very ancient formation. The *Rumonsch* is a written language, and books and newspapers are published in it. The dialect of the Engadin, or valley of the Inn, is called *Ladin*; it has still a greater affinity to the Italian or Lombard dialects. The Walloon of Liège and the Roumanian are also Romance languages. The latter is not derived from the original Roman colony of Dacia, but from a later importation of Latin from Istria or Italy.

ROMANESQUE, in architecture, is the general term used to describe buildings in styles imitative in the main features of Roman works. The arches are round, but as with Roman architecture, there are columns or pilasters upon the faces of the piers, and pilasters, cornices, and entablatures run like string courses along the walls; rectangular surfaces abound, and are decorated by sculpture in low relief, or by mosaic, &c. A large feeling for horizontal lines pervades all Romanesque styles. The chief varieties took definite shape as Norman, Lombard, Byzantine, &c., and are treated of in detail under their separate headings.

ROMA'NO, GIULIO. See GIULIO ROMANO.

ROMANS, EPISTLE TO THE, the first in importance, though not in date, of the epistles of the apostle Paul. Its genuineness and authenticity are admitted by the most destructive of modern critics, though there are some important differences of opinion as to its unity and integrity in the form in which it has come down to us. The points in dispute, however, relate almost entirely to the closing section of the epistle contained in chapter xvi., where the salutations seem more appropriate to the church at Ephesus than to that of Rome, and to the circumstance that there are no less than three concluding doxologies in the latter portion of the epistle—viz. xv. 33; xvi. 21, 25-27. That contained in xvi. 24 is omitted by the revisers of 1881, and they note in the margin that the concluding doxology is omitted in some MSS. of importance. Various theories have been propounded to account for the structure of this portion of the epistle, perhaps the most reasonable being that which considers it as having been sent, in the first instance, to Rome by the apostle, who also sent copies to Ephesus, Thessalonica, and elsewhere, with differing conclusions, all of which are preserved in the text adopted by the Authorized Version. The date of its composition may be ascertained within narrower limits than

that of any other of the Pauline epistles, the personal references it contains pointing most conclusively to the period covered by Acts xx. 2, 3, or the apostle's stay at Corinth towards the close of his third missionary journey, probably about 58 A.D.

The origin of the Christian church at Rome is involved in much obscurity, the tradition that it was founded by St. Peter being almost demonstrably erroneous. From the epistle itself, which contains no reference whatever to St. Peter, we learn that the church had been long established, and that it stood high in general estimation (i. 8), that it had not been visited by St. Paul, and that it was at this time composed of Hellenistic Jews, proselytes, and converts from the Gentiles, all of whom are appealed to in different portions of the letter.

The general outline of the epistle may be indicated as follows:—The opening salutation, which is unusually elaborate (i. 1-7); personal explanations (i. 8-15); statement of the chief thesis of the epistle—viz., justification by faith (i. 16, 17); a long argument to show that all men, Jews and Gentiles alike, are in need of salvation (i. 18—iii. 20); a repetition in an enlarged form of the doctrine of justification (righteousness) by faith, with certain corollaries (iii. 21-31); proofs and illustrations of the main thesis, chiefly drawn from scripture and the religious history of the Jews (iv. 1-25); the blessed results of the righteousness which is by faith (v. 1-11); a comparison between the condemnation of the race in Adam and its acceptance in Christ (v. 12-21); an exposition of the nature and claims of the Mosaic law as compared with the new dispensation of faith (vi. vii. 11); and finally, a fervid appeal to live worthily of this principle of a new and changed life, followed by a magnificent outburst of triumphant thanksgiving (vii. 12-39). The main argument of the epistle rises to its culmination in the eighth chapter, but during its progress a question of the highest importance has arisen—viz., what is the relation of Christianity to Judaism, and the consequences arising from the rejection of Christ by his own people? and this is considered in three succeeding chapters (ix., x., xi.) The remainder of the epistle, with the exception of the personal references given in chap. xv. 14-33, is devoted to solemn practical exhortations to holiness and duty, and after some greetings to various saints it closes with the benediction and doxology.

Although the Epistle to the Romans cannot be regarded as a compendium of the teaching of the apostle Paul, many important matters dealt with in other letters being omitted from this, it does undoubtedly contain the fundamental doctrines of his ministry, and at the same time it affords us a very striking expression of his personal character. Together with the profound thought, intense enthusiasm, and lofty eloquence with which he expounds his system of Christian doctrine, there are abundant evidences in the conciliatory language he employs, in the tenderness and earnestness of his appeals, and in the beautiful tact and discrimination of his practical counsels, of the all-pervading love and sympathy which marked the life of the apostle. From the earliest periods this epistle has exercised an all-powerful influence over the development of Christian theology, and it has been the study and admiration of some of the greatest minds which have been devoted to the service of the cross. Augustine founded upon its arguments the main principles of his doctrinal system. Chrysostom had it read to him twice every week. Luther styles it "the chief book of the New Testament;" Coleridge calls it "the profoundest book in existence;" and a modern American scholar, in a valuable study of the ideas of the apostle, asserts, "This letter is one of the greatest efforts of human genius. It is full of the inspiration of a heavenly love, and compact with the most intense effort of concentrated thought. In it Paul grapples with

his opponents, and pours out his heart, soul, strength, in his endeavour to convince, persuade, instruct, and convert them. The result is that, written with an immediate object, and with no thought of any future fame, it has become one of the great monuments of human intelligence, which will be studied and commented upon when the pyramids have crumbled into the sand of the desert."

Of the innumerable commentaries on this epistle those of Tholuck, Meyer, Jowett, Lange, and F. Godet may be consulted for the latest results of modern research and investigation; see also the list of works given at the end of the article under PAUL, St.

ROMANS, KING OF THE, the title borne by the elected (later on by the hereditary) successor to the Holy Roman (or German) Empire. It was common for the emperor during his lifetime to get his son elected and crowned King of the Romans. Sometimes the succession did not come off, as with our own Richard, king of the Romans, brother of our Henry III., who never really obtained the imperial crown, though he affected to use imperial rights occasionally.

ROMANTSCH LANGUAGE. See ROMANCE LANGUAGES.

ROMA'NUS, POPE, a native of Galliesium, was elected to the papal throne on the expulsion from the city of Stephen VI. or VII., in 897. He died, however, in January, 898, before he had been quite four months in possession of the dignity.

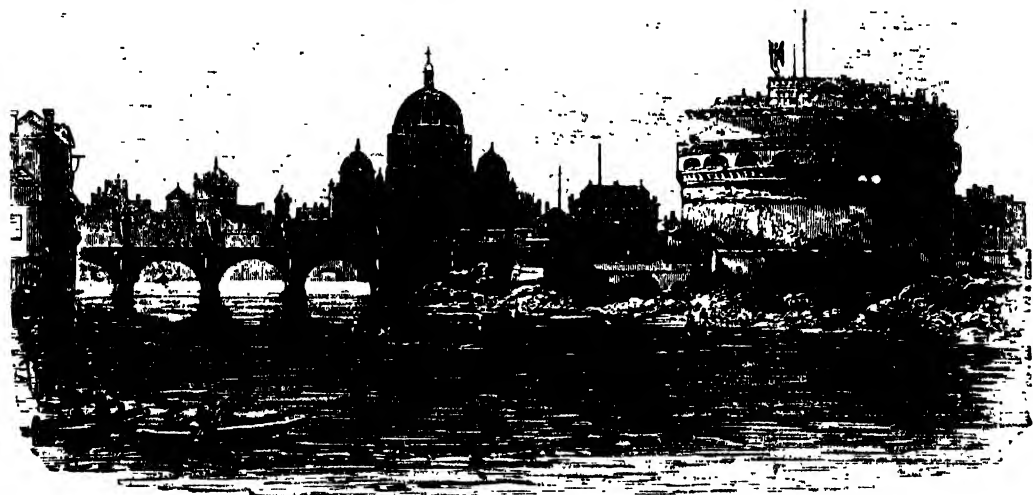
ROME, the capital and principal city of Italy—formerly the metropolis of the Roman Empire, and hardly less influential in later times as the capital of the Papal States and the headquarters of Catholic Christendom—is situated nearly in the centre of the wide undulating plain known as the Campagna, on the banks of the river Tiber, about 15 miles from the sea-coast, in 41° 54' N. lat., 12° 28' E. lon. It is 145 miles to the south-east of Florence, and 115 miles to the north-west of Naples.

The site of Rome consists partly of several strips of low land on both banks of the Tiber, and partly of the table-land of the Campagna, which rises on each side from 150 to 200 feet above the river. On the right bank of the river the Vatican and the Janiculum, which are within the modern city, are a continuation of the ridge of Monte Mario, which rises on the north to the height of 450 feet, and of Monte Verde to the south. On the left or eastern bank the table-land extends within the walls of Rome in a semicircular shape, forming several projections to the west towards the river. The low grounds between these projections and the river constitute the Campus Martius, on which the greater part of modern Rome is built. Beginning from the north, the first projection of high land within the walls is Monte Pincio (the ancient Collis Hortulorum); further east, and partly separated from it by a depression or ravine, is the Quirinal, and still further south-east the Esquiline. Between the Quirinal and the Esquiline lay a smaller projection, called the Viminal, which is now hardly distinguishable from the other two. The Quirinal, Viminal, and Esquiline are joined on the east by a plateau, which is about 150 feet above the ordinary level of the Tiber, and slopes gently towards the country outside of the walls. South of the Esquiline, and separated from it by a depression, is the Caelian Mount, which slopes eastward towards the country outside of Porta San Giovanni, and is divided on the south from the Aventine by the valley of the Marrana. Within the space intervening between the table-land and the Tiber, and in the middle of the ancient city, there are three small insulated hills—the AVENTINE, the PALATINE, and the CAPITOL—of which the Aventine is the most southern and the Capitol the most northern, and all of which are described in separate articles. The Capitol rises between the south-western extremity of the Quirinal and the left bank of the Tiber, and nearly fills up

the intermediate space. The ancient city lay south and east of the Capitol, and along the Palatine, Aventine, Caelian, Esquiline, Viminal, and Quirinal hills; the main part of the modern city lies north of the Capitol. By far the greater portion of the walled area, which, it is variously estimated, was inhabited during the imperial epoch by 2,000,000 to 5,000,000 persons, is now untenanted.

The Tiber, on approaching Rome from the north, makes a sweep to the east towards the base of Monte Pincio; but on reaching Ripetta, within the city, the river makes a bend to the westward, and flows along the north-eastern base of the Janiculum, after which it turns to the east as far as the base of the Capitol. It then turns again to the south-west, sweeping past the base of the Aventine, and along the southern extremity of the Janiculum; after which it assumes a course south by east. The level space between the Vatican Mount, the north end of the Janiculum, and the right bank of the river, is the Vatican field. It contains the Borgo, or suburb of Rome inclosed by the popes, St. Peter's Church, the Vatican Palace, and their appurtenances. The space between the long ridge of the Janiculum and the right bank of the Tiber constitutes the

district of the Trastevere, which is another suburb of Rome. The low-lying space on the left bank between the river and the eastern hills is the site of the modern city, which extends along the slope of the Pincian, Quirinal, part of the Esquiline, and the Capitol, forming a kind of triangle, of which the apex is to the north at the Porta del Popolo, and the base extends from the church of Santa Maria Maggiore on the east to the Tiberine island on the west, a distance of about $1\frac{1}{2}$ mile; while from the Porta del Popolo to the foot of the Palatine opposite Ponte Rotto, the most southern point of modern Rome, the distance is rather more than $1\frac{1}{2}$ mile. The modern city is divided by the Corso, or principal street of Rome. The municipal improvements which have been made since 1870 have formed an entirely new quarter on the ridges of the Pincio and Quirinal, in the eastern half. Several fine streets have been made, the most important of which is the Via Nazionale, which is an exceedingly handsome thoroughfare, and is now almost as much frequented as the Corso itself. In spite of the steepness of its gradients the Quirinal has also been covered with large and handsome houses, and with boulevards that vie with those of Paris and Vienna. The



St. Angelo and St. Peter's.

western half, called Trastevere ("*trans Tiberim*"), on the left bank of the river Tiber—which was the closely packed and tortuous Rome of the middle ages, and is still inhabited chiefly by the poorer classes—has also been much altered and broken up by the construction of new and wider streets.

The present line of the walls on the left bank of the river is supposed to be that commenced by Aurelian in 271, and completed in the reign of Probus; they were repaired by Honorius, and afterwards by Belisarius, and have been since restored by several popes. They form an irregular polygon, of which the longest diameter is 3 miles, from north-west to south-east. The whole circuit of the present walls, including Trastevere and the Borgo or Vatican, is about 14 miles. The wall is of brick, mixed with stones and rubbish; its height is about 50 feet on the outside, and seldom so much as 30 on the inner face. It has no ditch, but is flanked by nearly 300 towers and bastions, which were last repaired by Pope Benedict

XIV. in 1749. The city has twenty gates, eight of which, however, are now walled up. Of the twelve open the most important are the Porta del Popolo, on the road to Florence and Ancona; the Porta Pia, on the road to S. Agnese; the Porta S. Lorenzo, on the road to Tivoli; the Porta Maggiore, the finest of the city gates, on the way to Palestrina; the Porta di San Giovanni, on the highroad to Naples by Albano; the Porta S. Paolo, on the road to Ostia; and the Porta di San Pancrazio, on the Janiculum.

The Castle of St. Angelo (of which the massive circular tower was built by Hadrian for his mausoleum, and the fortifications around it, consisting of ramparts, ditches, and bastions mounted with cannon, were begun by Pope Boniface IX. and continued by successive popes) is the citadel of Rome, but it is not capable of prolonged defence as a military position. It formerly had a covered way leading to the Vatican. During the French occupation it formed the headquarters of their artillery.

The course of the Tiber within the city is, including its windings, about 3 miles. There are two points where there is a landing-place; one in the northern part of the town, called Ripetta, at which a modern bridge has been constructed, and where the boats from the inland provinces land wine and provisions; the other is at the south end of the city, where small vessels land their cargoes. There are several bridges across the river. The most northern is the bridge at Ripetta, built in 1878; the next and most important is the Ponte S. Angelo (the ancient Pons Ælius), built by the Emperor Hadrian, about 300 feet long; the Ponte Sisto (formerly the Pons Janiculensis), rebuilt by Sixtus IV. in 1474, about 300 feet long, connects the city with the quarter of Trastevere. About half a mile lower down is the island of San Bartolomeo (the ancient Insula Tiberina), of an oblong shape, about 1100 feet long and 330 in width, which is joined to the mainland by two bridges, the Ponte S. Bartolomeo (ancient Pons Cestius) connecting it with the Trastevere, and the Ponte de' Quattro Capi, so called from the four-headed Janusses which stand on the piers (the ancient Pons Fabricius) connecting it with the city on the left bank. There are also within Rome the remains of three ancient bridges: the Trionfalis, called also Vaticanus, just below Sant' Angelo, of which the piers have fallen in; the Pons Æmilius, now called Ponte Rotto, of which three arches remain on the Trastevere side, now rendered available for foot passengers by means of a suspension bridge carried from the extremity of the broken arches to the opposite bank, a little below the island; and lastly, the Pons Sublicius, at the foot of the Aventine, the first bridge built by the Romans, of which there are very few vestiges.

The water of the Tiber is turbid (the *fluvius Tiberis* of Horace), and rises to a considerable height after continued rain. The average width of the river is about 65 yards and its depth 20 feet, but it sometimes rises as much as 30 to 35 feet, as was the case during the great inundation of 1871. An artificial channel has since been constructed to prevent inundations in future. The navigation of the river, by means of which the commerce of imperial Rome was carried on in both directions, with transmarine nations as well as with the Italian provinces, is now comparatively insignificant.

The most characteristic feature of modern Rome is the number and magnificence of its churches, of which there are upwards of 800. The five principal churches are termed *basilicas*, from the fact that the earlier churches were transformations or imitations of the ancient courts of justice, which were so called. They are also called patriarchal, in honour of the patriarchates of the Catholic Church, viz. Rome, Constantinople, Alexandria, Antioch, and Jerusalem. They are the Vatican or St. Peter's, the Lateran or St. John's, the Librarian or S. Maria Maggiore, the Ostian or S. Paolo, and S. Lorenzo, the two latter being without the walls. St. Peter's and the Lateran have already been described in separate articles.

The basilica of S. Maria Maggiore, so called as being the principal of the 80 Roman churches dedicated to the Virgin, is situated on the summit of the Esquiline. The interior is peculiarly magnificent, consisting of an immense nave, divided from the side aisles by forty-two Ionic pillars of white marble. The roof is elaborately carved, and gilt with the first gold brought from South America to Spain. This basilica has attached to it various private chapels, full of objects of interest, especially that of the Borghese family. The basilica of St. Paul's, beyond the walls, on the way to Ostia, on the site of the traditional burial-place of the apostle, was one of the oldest and grandest of the Roman churches, divided into five aisles by four rows of Corinthian columns in different kinds of marble, twenty columns in each row; but it was accidentally burned in 1823. It has been rebuilt, however, on a scale of great magnificence, having now

eighty columns of granite with capitals of white marble. Many of the other churches in Rome are remarkable for their architecture, their paintings or other decorations, or their historical associations. Among the chief may be named the basilicas of S. Lorenzo and S. Agnese, outside of the walls; the latter, which has been thoroughly repaired, and is now one of the most beautiful in the vicinity of Rome, being the scene of the curious ceremony of blessing the two lambs which are to yield the wool to be employed for the *pallium*: the Church of S. Maria del Popolo, in which the Chigi Chapel was erected and decorated from the designs of Raffaele, the mosaics on the vault of the cupola representing the creation of the heavenly bodies; the S. Maria sopra Minerva (so called as being built on the site of a temple of Minerva), containing the statue of Christ by Michelangelo, the body of St. Catherine of Siena, the monuments of Leo X. and Clement VII., and numerous others, and having attached to it the headquarters of the Dominican order; S. Agostino, connected with the Augustinian order, possessing the celebrated fresco of Isaiah by Raffaele, and a marble group of the Virgin and Child, which is held in great veneration; S. Ignazio, the elaborately decorated church attached to the Collegio Romano, or Jesuits' College, the similarly embellished Il Gesù, the chief church of the Jesuits; S. Maria in Ara Celi, occupying the site of the ancient temple of Jupiter on the Capitol, possessing the figure of the infant Saviour, the *Santissimo Bambino*; S. Pietro in Vincoli, remarkable for its architecture, its association with the election of Hildebrand as pope, and its celebrated statue of Moses by Michelangelo; S. Maria in Cosmedin, at the foot of the Aventine, built likewise on the site of an ancient temple, and having several of the pillars which surrounded the temple still visible in its walls; and S. Maria in Trastevere, which has been constructed with columns taken from different edifices of classical times, some of which even yet present the heads of heathen divinities.

The chief palace of Rome is the VATICAN, which is described in a separate article. The palace of the King of Italy is at the Quirinal, formerly the residence of the Pope.

Rome possesses a great number of private palaces or residences of the nobility. Some of them are very large and have vast courts and long ranges of spacious apartments. The plan is generally a quadrangle, with a large staircase opening on the court. The windows of the ground floor are usually barred, giving the lower part of the building the appearance of a prison; the apartments of this floor are often let out to tradesmen, or used for stables, coach-houses, or offices. The chambers are so numerous that one floor affords sufficient accommodation for the family; hence it often happens that the owner reserves this portion for his own use, and lets out the remainder. The pillars and staircases are frequently of marble. The antechamber usually presents a lofty canopy or *baldachino*, on which the armorial bearings of the family are engraved. The principal palaces are the Barberini, one of the largest in Rome, with a collection of paintings (including the celebrated "Beatrice Cenci" by Guido), and a noble library of 7000 MSS. and 50,000 printed volumes; the Borghese, with its court surrounded by porticoes sustained by ninety-six granite columns, and a gallery of upwards of 850 paintings arranged in twelve rooms; the Colonna, with its great hall decorated with frescos commemorating the deeds of the Colonna family; the Corsini, with many treasures of art, a library of 1300 MSS. and 60,000 printed books, and one of the finest collections of engravings in Italy; the Doria-Pamphili in the Corso, with a spacious court surrounded by colonnades, and a collection of upwards of 800 pictures distributed over eighteen rooms; the Farnese, the finest in its architecture, being built of blocks of travertine taken from the theatre of Marcellus and the Colosseum, and formerly possessing a famous col-

lection of ancient sculpture, paintings, and books, which passed by inheritance to the late royal family of Naples, and is now in the museum at Naples; the Rospigliosi, which contains the fresco of Aurora by Guido; and the Ruspoli, with a staircase composed of 115 steps of white marble. The art treasures in most of these private palaces are generously thrown open to the public, with very slight restrictions.

There are numerous villas in Rome, both within and without the walls, chiefly the creation of cardinals, who have chosen to expend their wealth and display their taste in this form. The most important are—the Villa Albani, which, notwithstanding that the French carried off nearly 300 pieces of sculpture which were subsequently sold to the King of Bavaria, has still a collection of objects of art and antiquities inferior only to those of the Vatican and the Capitoline Museum; the Villa Borghese, whose pleasure grounds form a favourite resort and promenade in summer, and whose *casino* contains a very valuable collection of statuary; the Villa Doria-Pamphili, on the Janiculum, with grounds above 4 miles in circuit, laid out in gardens, avenues, terraces, and plantations; and the Villa Medici, on the Pincian Hill, the seat of the French Academy.

The Collegio della Sapienza, or University of Rome, has forty-two professors, in five faculties, and about 500 students, with a valuable museum. The Collegio Romano, or Gregorian University, is exclusively under the management of the Jesuits. It has a library rich in biblical literature; the Kircherian Museum, a very fine collection of classical and early Christian antiquities; and a well-equipped observatory. The Collegio di Propaganda Fide, founded in 1622 for the training of missionaries to infidel or heretical countries, has a library of 30,000 volumes, and a celebrated printing office, whence are issued works in a great variety of languages. The most important academies are the Accademia di S. Luca, for the fine arts; the Accademia de' Lincei, for the physical sciences; and the Istituto Archeologico, for the study of antiquities.

In addition to those in the Vatican Palace, Rome contains several museums of great interest, the two chief being the Capitoline, on the Capitol, and the Christian Museum. The former contains the well-known statue of "The Dying Gladiator," and the still more celebrated "Capitoline Venus," unquestionably the work of a Greek chisel, and the most admirable of all the existing copies of the Aphrodite of Cnidus by Praxiteles—the perfect type of feminine grace. The Christian Museum contains a large number of ancient Christian sarcophagi and a selection of ancient Christian inscriptions, which are an invaluable aid to the student of Christian archæology.

The number of charitable institutions in Rome is very great, and they are very richly endowed. The chief of them are the hospital of S. Spirito on the right bank of the Tiber, near St. Peter's, containing, as already mentioned, accommodation for the sick, foundlings, and lunatics; that of Santissimo Salvatore, near St. John Lateran, for sick and aged females; and that of S. Giacomo in Augusta, on the Corso, a surgical hospital. The great hospital of San Michele, at the Ripa Grande, which was formerly an asylum for the poor and infirm, has been changed into an industrial institution, which includes a house of industry for children of either sex, a house of correction for women and juvenile offenders, and schools of the industrial and fine arts. The workhouse of S. Maria degli Angeli, founded in 1824, contains nearly a thousand boys and girls, who are taught trades or what is necessary for domestic service.

Rome is abundantly supplied with excellent water. The chief fountains in the city are—the Paolina, which is the most abundant, and presents three cascades falling into an immense basin; the Fontana di Trevi, the largest of all, in which the water is made to flow over artificial rocks; the Fontana de' Termini, near the baths of Diocletian;

the three in the Piazza Navona; and those in the Piazza of St. Peter's.

The temperature of Rome is generally mild, the mean being 60 degrees. Frosts occur in December and January; but they are seldom of long continuance. The thermometer rarely falls below 25 degrees, and the frost disappears before the noon-day sun. December and February are the coldest, and July and August the hottest months in the year, the mean temperature being 47 degrees and 76 degrees respectively. Snow falls at times, but it seldom remains on the ground more than a day. The *tramontana*, or north wind, prevails often for a considerable period in winter and spring, and is cold and penetrating. In summer the heat is often oppressive, especially when the *sirocco*, or south and south-east wind, blows. The average rainfall at Rome is 16 $\frac{1}{4}$ inches. October is the most rainy month as to quantity, November as to the number of rainy days; the average number for the year is ninety-five. Fogs are rare. Since 1870 the sanitary transformation of Rome has been as complete as the structural, and from one of the most insalubrious cities in Italy it has become one of the most healthful.

The population of ancient Rome at the height of its power, though now not exactly known, must have been very great. (An interesting examination of this difficult subject will be found in an appendix to Mr. Story's "*Roma di Roma*," vol. 2.) During the middle ages it rapidly declined; but in the fourteenth century it began again to increase. In the days of Leo X. it is supposed to have amounted to 85,000. In 1765 it is given as 161,899; in 1800 at 153,000; whence it gradually fell to 117,900 in 1813. Since that time it has been on the increase. In 1871 it was 211,184, and in 1882 it had increased to 300,292.

The population is, so far as concerns race, necessarily of a very mixed character, having been for many centuries largely recruited by the influx of provincials and foreigners. Under the papal government the cardinals held the first rank in Rome as princes of the church; and these were followed by the nobility—a body consisting of about 180 persons who had by themselves or by their ancestors filled high municipal offices, designated collectively the Roman Patriciate, out of whom sixty selected from the oldest and most celebrated families bore the name of *Nobili Consacrati*. The power of granting letters of nobility, though not of conferring titles, was formerly vested in the municipality of Rome, and was much abused; but it was limited and regulated by Benedict XIV. in 1746. Of the princes and dukes, marquises and counts, whose names are inscribed in the *Libro d'Oro* of the Capitol, a few are wealthy, but the majority are comparatively poor and unimportant. The priesthood constitutes a numerous class. The Roman lawyers are also an important order, divided into *avvocati consistoriali*; *avvocati rotali*; *curiali*, solicitors; and *notari*. A great number of artists, many of them foreigners, are resident in Rome, and find a common bond in the Accademia di S. Luca, while France and other countries have also their separate academies.

Ancient Rome.—The ancient city lay chiefly on the hills to the south-east of the modern town. [See Plate ROMA ANTICA.] Its nucleus was, according to tradition, the settlement on the Palatine, around which gathered those on the Capitoline, Caelian, Aventine, Esquiline, Viminal, and Quirinal, as well as subsequently the portions of the Pincian and the Janiculan that were inhabited. It must suffice to mention here merely the most important localities. The heart of Rome was the Forum, presently to be described, which occupied the low ground south-east of the Capitoline and north-east of the Palatine as far as the ridge of the Velia. The Capitoline Hill had two summits, on one of which stood the Arx, or citadel; on the other the great national temple called Capitolium, dedicated to Jupiter, Juno, and Minerva. Various other

temples were erected on the hill, one of which was employed as the state treasury, while another had the mint attached to it. The Palatine Hill contained various objects associated with the early traditions—the thatched hut of Romulus the first Roman king, &c.; the temple and library of Apollo, built by Augustus after the battle of Actium; and the residences of many leading citizens, and the palaces of Augustus and his successors. The chief temple on the Aventine was that of Diana, the shrine of the Latin confederacy. In the hollow between the Aventine and Palatine lay the Circus Maximus, the original arena of the chariot races and other games which held so prominent a place among the institutions of Rome. The open space extending from the circus to the river formed the Forum Boarium, or cattle-market, with several temples to Heracles and one of Fortuna Virilis; and in its vicinity, at the base of the Palatine, lay the Velabrum, originally a swamp, but after being drained one of the great provision marts of the city. In the valley between the Caelian and the Esquiline lay the vast mass of the Colosseum, occupying part of the site of the "olden house" of Nero, which, even in its partly finished condition as he left it, straggled across from the Palatine to the Esquiline, including the slopes of both hills and the valley between. On the Esquiline were built the Thermae, or baths of Titus, while those of Diocletian, the largest structure of the kind, were placed on the height where the Viminal and Quirinal join. The baths of Caracalla, also a huge series of structures, lay beneath the Aventine and in the line of the Via Appia. Along the base of the Quirinal were ranged the Fora of the empire. Nearest the Comitium was the Forum of Caesar, and behind it those of Augustus and Nerva; the Forum of Vespasian lay between that of Caesar and the basilica of Constantine; and the Forum of Trajan, with the Ulpian basilica, the column and triumphal arch of Trajan, &c., the grandest structure of the kind, was situated to the north of Caesar's Forum. In the hollow between the Esquiline and the Quirinal lay the busy thoroughfare of the Subura. The low ground between the Tiber and the hills, which is the chief site of the modern city, was called the Campus Martius, and was employed for meetings of the citizens and for gymnastic and warlike sports; the southern portion, next to the Capitoline, was called the Flaminian Meadows. Here lay the Circus Flaminius, the Forum Olitorium, or vegetable market, various temples of note, and the three great theatres of Rome, named respectively after Pompey, Balbus, and Marcellus. In the more northern portion, or Campus Martius proper, were erected the famous Septa Julia, or voting inclosures, constructed of marble; the magnificent temple, with public baths adjoining, built by Agrippa, and commonly known as the Pantheon; the great mausoleum of Augustus, and the column of Marcus Aurelius. There was little of ancient Rome on the right bank of the Tiber; a portion of the present Trastevere was inhabited by persons of the humblest rank, and the Vatican was chiefly laid out in gardens. The mausoleum of Hadrian is now the Castle of St. Angelo. There seem to have been only three bridges over the Tiber down to the end of the republic, but other four were subsequently built. There were, according to Pliny, in the time of Vespasian no less than thirty-seven gates. Nine aqueducts supplied the city with water. It had been divided by Augustus into fourteen regions.

Remains of the Ancient City.—These are numerous and various. The most extensive ruins are, perhaps, those of the public baths or thermae with which the names of Titus or Trajan, Caracalla, and Diocletian are respectively associated. The Baths of Caracalla, to the south of the city, occupy an area of nearly a mile in circuit, and are said to have accommodated 1600 bathers at a time. The design included porticoes, gardens, a stadium, and a large reservoir. Those of Diocletian were still larger, capable of

furnishing twice as many baths: the great central hall has been converted by Michelangelo into the Church of S. Maria degli Angeli, "whose vaulted roof still retains the metallic rings to which the ancient lamps were suspended." A corridor belonging to the Baths of Titus presents a beautifully painted ceiling, the most perfect specimen of ancient painting to be found in Rome, and the source whence Raffaele drew inspiration for the loggie of the Vatican. There are more or less extensive remains of the temples of Vesta, Minerva, Bacchus, Concord, Ceres and Proserpine, Fortuna Virilis, and various others, several of which have been converted into Christian churches. But by far the finest and best preserved monument of ancient Rome is the Pantheon or Rotonda, built by Agrippa B.C. 27. The portico is 110 feet long and 44 deep, and is composed of sixteen Corinthian columns of granite 13 feet in circumference, with capitals and bases of white marble; the beauty of its proportions has excited universal admiration. The interior is round, 142 feet in diameter, exclusive of the walls, which are said to be in some places 20 feet thick. The height from the pavement to the summit is 142 feet, of which the majestic dome occupies the half. The Pantheon is the burial-place of Raffaele and many other great artists, and also of Victor Emmanuel, the first king of United Italy. Behind the Pantheon lie large remains (excavated 1881–82) of the Baths of Agrippa. It remains doubtful what function the Pantheon served, whether as vestibule to the baths, as their temple, or what else. There are fragmentary remains of several theatres and churches; and the Roman amphitheatre is still represented by the Colosseum, the most stupendous ruin in the world.

Of the remains of the ancient gates, the most considerable are those of the Porta Maggiore, formed by the two arches which carried the Claudian aqueduct over the ancient Porta Labicana and Porta Praenestina. This magnificent façade consists of two great archways, and three piers, each decorated with two rusticated columns of the Corinthian order, placed on a rustic basement, and supporting an entablature and pediment. Above these is the lofty attic, in which are the two water channels; and which exhibits three inscriptions, indicating the construction of the aqueduct by Tiberius Claudius, and its restoration by Vespasian and by Titus. This structure is one of the best preserved and most imposing in Rome.

The Column of Trajan, erected in 114, composed of thirty-four blocks of white marble, is admired both for the excellence of its proportions, and for the design and execution of the noble series of bas-reliefs carried spirally round the shaft, and representing the military achievements of the emperor. These sculptures, which contain no less than 2500 human figures, are, in addition to their value as works of art, especially valuable as illustrations of ancient costumes and of military antiquities. The height of the shaft is 97 feet, and that of the entire column, exclusive of the bronze statue of St. Peter now placed upon it, 127 feet. In the interior is a spiral staircase of 184 steps, lighted by forty-two openings. The Antonine column in the Piazza Colonna, erected to Marcus Aurelius in 174, is, in height and general design, a repetition of that of Trajan; but the bas-reliefs are very inferior in execution. It is now surmounted by a statue of St. Paul. The triumphal arches are among the finest and most interesting monuments of ancient Rome, especially those of Titus, Severus, and Constantine. The arch of Titus, placed at the highest point of the Via Sacra, is the most elegant, and possesses a peculiar interest from its commemorating the destruction of Jerusalem, and representing the spoils carried off from the Temple. It consists of a single arch of white marble, with fluted columns of the Composite order on each side. The arch of Septimius Severus was erected in honour of himself and his sons by the senate in 208, and consists of one central and two lateral arches. It is constructed of

white marble, and presents on its several fronts a series of bas-reliefs, indifferent in execution, which depict numerous details of Oriental warfare. The arch of Constantine, built to commemorate his victory over Maxentius, fronts the Colosseum, and is in excellent preservation. It is partly composed of fragments taken from the grand arch of Trajan, formerly adorning his forum, and of bas-reliefs relating to the history of that emperor, which are of great excellence, and are easily distinguished from the inferior sculptures of the later epoch of Constantine. It has three archways with four fluted Corinthian columns on each front. The sites of the principal ruins are indicated in the Plate ROMA ANTICUA.

Some of the tombs are interesting for their inscriptions or their historical associations. We have already mentioned the great mausoleums of Augustus and of Hadrian, now respectively a circus and a fortress. Among the others may be named the tomb of the Scipios near the Porta S. Sebastiano; the tomb of Cecilia Metella, the wife of Crassus, on the Appian Way, one of the best preserved monuments of Rome; the tomb of the baker Enryaces; and the pyramid of Caius Cestius, situated close to the Porta di S. Paolo, 114 feet high, formed of brick and tufa in the centre, and covered with slabs of white marble from the base to the summit. A different but not less deep interest attaches to the Catacombs—the network of subterranean passages and galleries which formed places of refuge and worship, as well as of interment, for the early Christians. They lie, in general, outside of the walls; ^{about sixty have been reckoned up, and it has been calculated that they contain the remains of 6,000,000 dead.} The Christian inscriptions from the Catacombs, amounting to 11,000, have been collected and published by De Rossi, who has also issued a portion of a general work on the subject, entitled “Roma Sotterranea.”

Forum Romanum.—As early as 1519 Raffaele had indeed formed a plan for restoring the ancient city, and especially the Forum, by means of extensive excavations; and during his lifetime, and subsequently, particularly in 1546–47, the work was begun in the neighbourhood of the temples of Castor and of Faustina. The object in view, however, being merely the discovery of monuments and works of art, the excavations were soon filled up again, and in the seventeenth and eighteenth centuries were altogether discontinued. However, in 1803 Carlo Fea disinterred the arch of Severus, in 1813 the column of Phocas (A.D. 608), and in 1816–19 the temple ruins at the base of the Capitol. Then came another lull, till 1828, at which time our Plate II. represents the Forum. (At this time herdsmen brought their teams into the Forum as a sort of free common, so that it gained the name of the *Campo Vaccino*.) Small works were done now and again, and under the short-lived republic of 1848 plans of regular procedure were sketched out, and the Emperor Napoleon III. of France began excavations on the Palatine; but nothing of real value was done till 1871, when Rome, once more the capital of Italy, celebrated her enfranchisement most worthily by disinterring at immense cost her ancient glories. A commission of archaeology was instituted, and a large staff of artists, antiquaries, and assistants, together with an efficient staff of porters and police, was organized to take possession of all artistic “treasure-trove,” and to preserve all architectural monuments. The result is shown in Plate III. (FORUM ROMANUM).

The Forum lies in what was originally a deep marshy valley between the Capitol and the Palatine. The pavement by the column of Phocas still lies 38 feet only above the level of the sea, and 22 feet above the normal level of the Tiber, and is 13 feet lower than the height of an ordinary inundation. In consequence of the lowness of this valley it was a difficult task to drain the marsh. For this purpose Tarquinius Priscus, the fifth of the kings, is said

to have constructed the *Cloaca Maxima*, which still renders good service [see Plate], and several *canalicole*, or tributary drains which fell into the main channel, have recently been discovered. Tradition makes this hollow the scene of the conflict of the Romans under Romulus against the Sabines under Titus Tatius after the rape of the Sabine women. After the hostile tribes were amalgamated into a single state, they chose the Forum as its centre (Lat. *forum*, a hearth), and it was here that some of the most famous scenes in the history of the Roman Republic were enacted. On the north side lay the *Curia Hostilia*, or council-hall (now the Church of S. Adriano), which is said to have been erected by King Tullus Hostilius; while on the south side, at the foot of the Palatine, rose the Temple of Vesta, built by Numa, with its eternal fire, and the *Regia*, or dwelling of the Pontifex Maximus, the president of the Roman hierarchy. The Regia (king's house) was at first the dwelling of King Numa, and hence passed to his successors in the religious headship. Julius Cæsar lived there. Augustus preferred the Palatine, and gave the Regia to the Vestal Virgins, who built a new abbey-palace there (excavated 1883–81). The *Comitium*, an open space, was the place where popular assemblies were wont to be held. The Forum was bounded by streets, the most important of which was the Via Sacra, ascending to the Capitol. The Basilica Julia marks its south boundary, the Rostra and Rostra Julia respectively the west and east, and the Comitium and Basilica Æmilia, now lost, the north. Along the sides of the Forum were ranged the *tabernæ* or shops which

all
 were
 occupied by butchers and other craftsmen, and afterwards by money-changers and goldsmiths. In the course of time a number of temples, public buildings, and monuments were erected round the Forum. Of those still existing the most ancient is the *Carcer Mamertinus* or well-house, situated on the slope of the Capitol, the foundation of which reaches back to the period of the kings. Soon after the temple of the Capitoline Jupiter were founded the temples of Saturn (B.C. 501) and Castor and Pollux (B.C. 482), rebuilt by Tiberius under Augustus A.D. 6. The Temple of Concord (B.C. 367), also rebuilt by Tiberius in A.D. 6, commemorates the termination of the protracted struggle between the patricians and the plebeians. At the period of the Samnite War, which resulted in the extension of Rome's supremacy over the whole of Italy, we are informed that the Forum underwent many embellishments. At last, however, as it was only 150 yards in length, its area became too confined for the important and multifarious business transacted within its precincts; for it was not used for political and commercial purposes only, but for the celebration of the funerals of the nobility, for the gladiator combats, which were introduced about the year 264, and on other public occasions. The first expedient for gaining space was the erection of basilicas, or quadrangular courts surrounded by colonnades, adjoining the Forum, with a view to draw off a portion of the traffic. In B.C. 184 Cato erected the Basilica Porcia on the north side; in 179 followed the Basilica Æmilia, and in 169 the Basilica Semproniana. The task was prosecuted with the utmost energy by CÆSAR, who extended the Forum by the addition of the Forum Julium, or Forum of Cæsar, and appears to have projected a cutting through the hill which connected the Capitol with the Quirinal in order to facilitate communication with the new quarter which was rapidly springing up in the Campus Martius. He also restored the Curia Hostilia, and erected the spacious Basilica Julia on the south side of the Forum. Augustus proceeded to carry out the plans of his uncle, and to that emperor is chiefly due the arrangement of the Forum which the present excavations have brought to light. All the edifices of the republic were restored by him and his successors, whose energetic building operations extended over the first four

centuries of the Christian era. They thus endeavoured, as it would appear, to compensate their subjects by external magnificence for the loss of liberty they had sustained. Five new fora, constructed between the time of Caesar and that of Trajan, adjoined each other on the north side of the old Forum, thus connecting the central point of the original city with the palatial buildings of the Campus Martius. By these new fora the Forum of the republic would have been well nigh eclipsed, but for the glorious traditions connected with it, to commemorate which it was splendidly decorated with statues and inscriptions and works of art of all kinds. The Tabularium, on the left (west) of the Forum, was erected as a record office for the storing of the archives (*tabularia*) by Q. Lutatius Catulus (B.C. 78). There were five storeys of warehouse-like chambers, the lowest having an open arcade towards the Forum. This was used as a salt-magazine in the middle ages to the infinite danger of the stones. Below it is seen the Colonnade of the Twelve Greater Gods (xii. *dii consentes*), whose images were set up in this colonnade by the prefect of the city in A.D. 367 as a protest against the growing power of Christianity. Part of the colonnade bears the name of the *Schola Aulica*, as if it had been a portico (for disputation, &c.) in the Greek sense of the word. The Temple of Vespasian was erected by Domitian (A.D. 94) to his father's memory, and restored by Septimius Severus. The existing three columns are part of the original temple; they are far too fine for the age of Severus, which produced nothing nearly equal to them. The adjoining temples of Concord and of Saturn have already been mentioned. Skirting the latter, which also contained the public treasury, wound the Clivus Capitolinus, then the only approach to the summit of the steep hill, except some steps on the north side of the tabularium leading up to the Arx, or citadel, the northern summit of the Capitol. From the foot of the Clivus Capitolinus extends eastward the Via Sacra, along by the Basilica Julia and Temple of Vesta to the arch of Titus and the Colosseum (not shown in the Plate). In later imperial times its course was diverted northwards, so that it passed through the arch of Severus, and not that of Tiberias (the latter now lost); but a passage in Horace confirms the scanty remains of pavement as to the original line of this most famous of roads. The arch of Severus, just mentioned, 75 feet high, 82 broad, with three passages, was erected in honour of that emperor and his two sons, Geta and the infamous Caracalla (A.D. 203), after some Oriental victories. Severus, crowned by Victory, surmounted the arch. This figure is lost. When Caracalla murdered his brother, after Severus' death, that he might reign alone, he erased Geta's name from the inscription. Adjoining the arch is the Rostra, which Julius Caesar rebuilt here in B.C. 41, removing it from the original site in front of the Curia. Augustus afterwards built, in front of the temple dedicated to his adopted father, Julius Caesar, and which bounds the Forum to the eastward, a second rostra, called the Rostra Julia. The Rostra (65 feet long by 16 feet wide) was ornamented by the beaks (*rostra*) of the ships taken in the first great naval victory, that of Actium in B.C. 338, and the Rostra Julia with the beaks of the ships of Antony and Cleopatra taken at Actium (B.C. 29). The Rostra was the place whence public orations were delivered. Mark Antony's oration was given from the Rostra Julia, which also was the place where he presented Caesar, in vain, with the regal crown inviting him to declare himself king. At its back is a curved structure called the *Græcostasis*, the Greeks' stand, or place whence foreign ambassadors were allowed to speak. This was contiguous to the original Rostra, and was therefore removed to the new place by Julius Caesar in B.C. 41. The *Milliarium* and *Umbilicus* are seen to south and north of it respectively. All distances were measured from the first, and the second was the heart (navel) of the city.

Two beautiful marble bas-reliefs from the stairs to the Rostra are preserved in the Forum; they are of the date of Trajan. Eastward in the Forum is seen the extensive base of an equestrian statue, almost certainly that of Domitian. The busy street called *Vicus Tuscus*, to the west of which ran the *Cloaca Maxima*, passed along between the Basilica Julia and the Temple of Castor and Pollux, erected in B.C. 484 in gratitude for their supposed share in the victory of Lake Regillus (B.C. 496), and rebuilt by Tiberius (A.D. 6). Eastward of this temple, which was often used for meetings of the senate, was the abbey of the Vestal Virgins, but on the site of the ancient Regia, as before mentioned, and south of it was the Temple of Augustus, the ruined site of which is still imperfectly authenticated. The virgins' house lay back against the actual rock of the Palatine, and must have been very damp and sunless. Curious architectural precautions seem to have been taken on this score. See VESTAL VIRGINS.

In 1884 a remarkable treasure was found in the Vestals' Palace in the shape of over 800 coins in an earthenware jar, all of early English coinage, and evidently by the evidence discovered at the time belonging to an official under Marinus II. (942-946). It is believed that the popes and their court were at this time and later (till the Frangipani turned them out) inhabiting the slope of the Palatine Hill between the arch of Constantine and the Temple of Castor and Pollux. The coins are of Alfred the Great, Edward the Elder, Athelstan, Edmund the Elder, &c.; and the reason of their presence at Rome is not very difficult to find. *St. Peter's Pence* was a church tax instituted by King Offa, and confirmed from time to time, especially by Edward the Elder, who sent yearly 42,000 denarii to Rome. Later on this contribution was levied in other lands, but in the reign of Marinus the English were the only nation supporting the Pope with their money. One cannot help feeling a certain national pride in the fact.

Opposite the nursery of these famous ladies, who were a real power in the state, as the numerous statues and inscriptions in their honour show, erected by their grateful *protégés*, and beyond both arms of the Via Sacra, stands the Temple of Faustina, erected to her memory by her husband the Emperor Antoninus Pius in 141, and the portico of which was excavated in 1809. The interior (entered from a back street) has been used as the church of S. Lorenzo in Miranda since 1377. The Church of Saints Cosmas and Damian, which lies not far to the eastward of San Lorenzo, is the ancient *Templum Sacræ Urbis*, and lay between the Forum Pacis or inclosure of Vespasian's Temple of Peace (now lost) and the great basilica of Constantine; the last erected in part by Maxentius, but renamed after his defeat by Constantine (in 312), who altered and finished it somewhat later. Its fine arches served both Brunellesco and Michelangelo as studies, when the first was planning the dome of Florence, and the second that of St. Peter's. Returning to the Temple of the Sacred City (*Sacræ Urbis*), it may be added that it was a sort of municipal record office, and contained a plan of all Rome made by order of Vespasian, of which fortunately a great part is preserved, though in a dreadfully fragmentary condition. The entrance was, and still is, through the small circular-domed temple of Romulus, built by the Emperor Maxentius in honour of his son of that name.

These ancient buildings were restored for the last time in the reign of King Theodoric, in the first half of the sixth century, and the last new monument erected in the Forum was the column of Phocas (disinterred by the care of the Duchess of Devonshire in 1813), dating from 608 A.D. the rudeness of the architecture distinctly betraying the degraded taste of the period. As early indeed as the first half of the sixth century had begun the war of extermination waged by the middle ages against paganism. Ancient temples were transformed into churches, such as

those of S. Giuseppe, S. Lucia, S. Adriano, S. Lorenzo, SS. Cosma e Damiano, S. Francesca, and S. Maria Liberatrice. Interspersed with these churches were the towers and castles of the Roman nobility, erected among the ruins of the ancient buildings in the style best adapted for the prosecution of their perpetual feuds. Throughout a thousand years the edifices of ancient Rome were employed as quarries, from which churches and secular buildings alike derived their columns, their blocks of solid stone, and, owing to a still more destructive proceeding, their supplies of lime also from the burning of marble. The fact that in the Basilica Julia alone there have been discovered lime-kilns and stone-masons' yards at three different places will convey an idea of the vast quantity of marble, bearing valuable inscriptions and artistic enrichments, which must have been destroyed in this way; and it need hardly be observed that the bronzes of antiquity were still more eagerly appropriated in an age when metal of every kind was scarce. This accounts for the miserably small number of statues and inscriptions which modern excavations have yielded. Down to the eighth century the ancient level of the Forum was unaltered. In the eleventh and twelfth centuries the Forum was thickly covered with towers and fortress walls, which closed up the old streets, and when these walls were demolished about the year 1221, the ground appears for the first time to have been covered with an accumulation of rubbish, which grew with further demolitions until now it is in places 40 feet deep.

Even now, vast as is the improvement, all is not as it might be. Sometimes, as in the Basilica Julia and the Basilica Ulpia (Trajan's Forum), the restorations are disastrously false; and in some of the finest remains prone columns (as in the Temple of Saturn in the Forum) have been actually erected upside down. The ancient remains in Rome are therefore a source of perpetual employment to classical antiquaries, who have to be ever watchful to prevent new vandalism and ever diligent to correct as far as possible the barbarisms of past ages.

A very remarkable set of buildings surround Rome at short distances in the shape of the Roman ancient villas—not the beautiful villas of papal times, which replaced some of them and surrounded Rome with a ring of splendid gardens and palaces, now unhappily fast disappearing year by year; but the residences of the Romans of the republic and the empire. These villas stand in what are now terribly unhealthy spots; and there seems reason to believe that although the hygienic conditions of the Campagna were much better in ancient times than they are now, still the villas, built, as many are, at the very foot of the hills surrounding Rome, could not have been perfectly healthy residences in the summer time. And when we consider that there are hundreds and hundreds of villas lying still lower, between the hills and Rome itself, in regions more subject to malaria, we wonder that powerful and wealthy families did not select more salubrious places for their costly establishments. The solution of the problem is this. The aristocracy of Rome, like the English aristocracy of the present age, were brought up for public service. They did not vegetate in idleness, but they served their country at the head of the frontier legions when young, and at the head of the provincial or central administration when tired of the field. From this resemblance in the moral condition of the two aristocracies comes the resemblance in the system of their material life. The Roman patricians, like the English, kept their house open in the capital, and a house worthy of the social position of the owners, in which hospitality was practised during the winter season, as it is practised now during the London season. However, the Roman season was exceedingly short. As soon as the first symptoms of the coming spring were felt the patricians dispersed themselves among their villas, which encircled and surrounded the town, between the fourth

and the tenth milestones from the *Milliarium Aureum*. Being so near the centre of business, they could attend their duties day by day without much inconvenience; they could administer the *cura aquarum, annonæ, Tiberis et cloacarum*, or act in their capacity of judges, of prefects of the *Prætorii et Urbis*; they could also perform their parliamentary duties. At the same time the comparative seclusion of their charming residences (in which private *stadia, huli*, and *hippodromi* represent the lawn-tennis, cricket, and coursing grounds of to-day) enabled them to enjoy a comparative rest, to watch more closely the education of their children, to acquire fresh energy and higher spirits for their next journeys in the far-away provinces of the empire. These villas, accordingly, must be considered to have been more like town residences than country seats, and were occupied only before and after the heat and the malaria of the summer months; they were not occupied in summer. Many patrician families owned two or more villas within a radius of a few miles, but at different levels—one nearer to the city and within the reach of malaria; the other on the Alban, Tusculan, and Tiburtine Hills, above the level of the suspicious districts. One example out of many will suffice. The two brothers Quintilius Condianus and Quintilius Maximus possessed a large estate at the fifth milestone of the Appian Way, 320 feet above the sea, and a still larger one at the twelfth milestone of the Via Tusculana, 800 feet high.

History of Rome.—Although the discovery of extensive Etruscan remains at Rome in a large necropolis on the Esquiline in 1885 led some rash enthusiasts to declare that Rome was in origin Etruscan, there seems to be no real reason for disturbing the conclusions gradually arrived at by many converging lines of evidence. It is now thought that the Aryan or Indo-European people, whom we call Italians, completely swept away the aborigines from those parts of the peninsula they occupied. Part of Italy was colonized by Greece, the Hellenes being but another nation of the same stock, another wave of Aryan immigration into Europe; and in these southern parts of Italy remnants of a stock called provisionally Iapygian have been found whose language is not akin to any known tongue, and presents as yet an unsolved puzzle. This may possibly have been the aboriginal population. The northern part of Italy (Tuscany, &c.) was held by the Etruscans, a people whose race affinities are as yet a sealed book. Their civilization was much advanced earlier than that of the Romans, and this is the reason of the early remains at Rome bearing Etruscan characters. The earliest settlers at Rome were doubtless unable to make the articles they needed for household use, and got them from the Etruscans. To the north-west of the Etruscans, spreading all across the land from the sea to the river Po, lay the Ligurians, also a race of unknown affinities. For centuries all of what is now called North Italy was denominated Gaul.

The Italians who held the middle of the peninsula were divided into Latins and Umbrians, the former dwelling in the western half, the latter in the eastern half. The great central Latin settlement was in the plain of Latium, bounded by the Etruscan territory to the north, and by the Umbrian Sabines on their Apennines on the east, and measuring about 700 square miles. Through this plain the Tiber flows to the sea, and about 14 miles from its mouth it cuts through a group of hills. Three small bodies of men seem in early times to have dwelt upon the hills of the left bank, which are lower than those of the right, and by coalescing to have made a community strong enough to hold its own. These were called, as far as we can guess through the mists of tradition, Ramnes, Titnes, and Luceres; and the first probably were Latins, and gave their name to the city. Thus it is that so many things are threefold in ancient Rome, the tribes, the vestals, the augurs, the chief priestly bodies, &c., all threes or multiples of three

The Luceres were probably Latins, like the Ramnes, but the Tities, by tradition, are Sabines—that is, not of the Latin but the Umbrian stock of the Italian people. The new nation controlled the great waterway of the Latin people, and soon therefore rose to great power, quickly obtaining the hegemony or leadership of Latium, though not without a struggle. The original city, surrounded by a strong ring wall, lay, no doubt, as tradition asserts, on the Palatine. As the little state grew, new “rings” were needed, and were added on the neighbouring summits. Of course the heights were then more distinct than they are now, after twenty-five centuries of levelling have passed over them. There grew up seven distinct ring walls, and this form of the city was preserved in memory by an ancient festival, the *septimontium*. The seven rings were (1) the Palatine summit; (2) the Cermalus, a second part of the Palatine; (3) the Velia, joining the Palatine to the Esquiline; (4) the Fagatal; (5) the Oppian; (6) the Cispian, three summits of the Esquiline; and (7) the Subura, a fortress in the low ground protecting a suburb on the Caelian between the Esquiline and Quirinal. This is the true Rome of the “seven mountains;” but there grew up another Roman community on the Quirinal Hill, who called themselves the “men of the hill,” a name preserved in the Colline (or hill) gate, and in many other ways. These two communities eventually coalesced, and this accounts for the number of pairs found among Roman officials, two ranks in the tribes, two sets of three of vestals, two sets of priests of Mars, two legions always called out together, &c. In the conservative Roman way all these customs lasted for centuries; and however meaningless they at length became, no one would be so impious as to destroy them. But Rome now grew apace, and there came fresh persons to the town; inhabitants of conquered Latin towns were brought in, and hangers-on of all kinds arrived and settled. Tradesmen and foreigners also flocked to Rome. These attached themselves to some one or other of the *burgesses*, and were known collectively as the *PLEBS*. In the article of that name the intensely interesting struggle whereby the plebs at last attained full citizenship is shown.

1. The legendary history of Rome is of course far different from what has just been advanced. The myth of its foundation is recounted in the article *ROMULETUS*; but it was not till a comparatively late period that this well-known legend, the *Regal Period*, was framed, and the year B.C. 753 fixed as the date of the foundation of his “*Roma Quadrata*.” Modern excavations have brought to light portions of the wall, gateways, and streets which belonged to the most ancient settlement, whether it be of Romulus or another. After the town of Romulus had sprung up on the Palatine, a second, said by tradition to have been inhabited by Sabines, was built on the Quirinal, and the two were subsequently united into one community, though probably not in the manner recounted by the familiar myth. While each retained its peculiar temples and sanctuaries, the Forum, situated between them, and commanded by the castle and the temple of Jupiter on the Capitol, formed the common focus and place of assembly of the entire state, and the Forum and Capitol maintained this importance down to the latest period of ancient Rome.

While the origin of the capital of the world is traditionally referred to Romulus, its extension is attributed with something more of certainty to Servius Tullius. Around the twin settlements on the Palatine and Quirinal, extensive suburbs on the Esquiline and Caelian, as well as on the lower ground between the hills, had sprung up; for not only were numerous strangers induced to settle permanently at Rome on account of its commercial advantages, but the inhabitants of conquered Latin towns were frequently transplanted thither. Out of these heterogeneous elements a new civic community was organized, towards the close of the period of the kings, and its constitution

commemorated by the erection of the Servian Wall, considerable remains of which are still extant. This structure, which was strengthened by a moat externally and a rampart within, is of great solidity: it inclosed the Aventine, the Caelian, Esquiline, Viminal, Quirinal, and Capitol, which seven hills eventually superseded the original seven as those typical of the seven-hilled city, and is computed to have been about 7 miles in circumference. While care was taken thus to protect the city externally, the kings were not less solicitous to embellish the interior with handsome buildings. To this period belongs the circus in the valley between the Palatine and the Aventine, and above all the Cloaca Maxima, which was destined to drain the swampy site of the Forum, and is still admired for its massive construction. This energetic and brilliant development of the city under the kings of the Tarquinian family in the sixth century came to a close with the expulsion of the last king, Tarquinius Superbus (B.C. 509)—a crisis immediately followed by a great shrinking of territory. All the “regal period” of Rome is quite vague, except perhaps the very latest sovereigns. The accepted dates by the old easily-satisfied historians of Rome herself were—Romulus, the civic founder, B.C. 753–714; Numa Pompilius, to whom all the religious and legal usages were referred, B.C. 714–673; Tullus Hostilius, B.C. 673–611; Ancus Marcius, grandson of Numa, 611–616. Then follow three kings of Etruscan origin or connection: Tarquinius Priscus, B.C. 616–578; Servius Tullius, who reorganized the state on a military basis, enlarged the bounds of the city, and established the mastery of Rome over Latium, B.C. 578–534; and finally Tarquinius Superbus, son of the Elder Tarquin, and son-in-law of Servius Tullius, B.C. 534–510. This seems to point undoubtedly to a period of Etruscan domination, disguised so as to give no offence to Roman patriotism. Such a theory would explain better the revolt against the Tarquins than the well-known legend of Lucretia, and would also account for the diminution of Rome’s power and territory so suddenly occurring.

II. *The Republic*.—A second period commences with the republic and extends to the dictatorship of Sulla (B.C. 82). There seems to have been little immediate change in the Roman constitution after the expulsion of Superbus; for the two consuls exercised annually the functions and the power of the kings, and the patricians or ruling class engrossed the consubship and the honours and emoluments of the state. The struggle of the patricians and plebeians which now followed is one of the most instructive histories on record, and is elsewhere fully given. [See *PLEBS*.] Continual conflicts marked the first centuries of the republic. Foremost of her difficulties was the contest with the Tarquins, who repeatedly sought to return. A battle of great fame, fought at Lake Regillus against the Latin allies of Tarquin, ended the struggle (B.C. 496), and Superbus himself withdrew to Capre to die. His tomb has recently been discovered there. Henceforth Roman history is clear and reliable, and full of interest and value.

The Etruscans still held the country to the north of the Tiber, and threatened Rome continually. During the contest with the expelled king the Etruscans had encamped against the gates of Rome, and their neighbourhood was a perpetual danger. The Oscan or Umbrian nations of the *Æqui* and *Volsci* also harassed Rome. Finally the conquest of the Etruscan city of Veii (B.C. 396) gave Rome dominion as far as the Ciminian Forest; but at a price which left her powerless in the face of a new and terrible foe, the barbarian Gauls. The city fell before them (B.C. 390). Fortunately the storm passed as quickly as it came. Rome was hastily rebuilt, so hastily, in fact, that it remained a poor and unattractive city, in spite of its power and size, until the time of Augustus; the streets were narrow and crooked, and the houses small and uncomfortable.

Gradually the Romans extended their sway and began to dominate the entire peninsula. The other half of the Italian folk, however, the Oscan or Umbrian peoples, had also developed some kind of a national life, though much more loosely connected than the Roman and other Latin races. The chief group of Oscan nations was the Samnites, a brave mountain people occupying the Apennines to the south of Rome. With these, from B.C. 343 onwards for about sixty years, the Romans waged three bitter wars, at first almost on equal terms. The first Samnite War lasted from 343 to 340; the second from 326 to 308; and the third from 298 to 290, the Etruscans and Gauls (Gauls of North Italy, not of France) assisting in this supreme effort to check the all encroaching power of the great city. It was in vain, and soon after the latter date Rome was fairly mistress of the peninsula. A few Greek cities in the south alone retained their independence.

What had stood Rome in good stead in this long and trying time of the struggle for supremacy was her close organization as a military commonwealth. It must never be forgotten in regarding the history of Rome that we are witnessing the attempt, and the long successful attempt, to govern the world by a mere municipal town council of a large kind. The city government of Rome was stretched and stretched to cover more and more until there is little wonder that it burst in pieces. It was a very long time before Rome admitted even Italian cities to Roman citizenship; and even when this was tardily done under the dire pressure of necessity, the only way in which such cities could influence affairs was by sending delegates to Rome to give their votes personally in the great assembly. Most cities had only the partial freedom called the Latin franchise, and had but little voice in matters of state, though free to deal with their own municipal affairs.

Soon after the defeat of the Samnites one of the Greek cities of the south, called Tarentum, fell into a quarrel with the new masters of the land, and applied to their fellow-countryman Pyrrhus, or Pyrrhus, as the Romans call him, the powerful Greek King of Epeiros, for help against Roman tyranny. Pyrrhus was the greatest general of his time—adventurous, and ambitious of rivaling Alexander the Great, moreover; he therefore needed little pressing to take up the quarrel and invade Italy as the champion of Greek civilization (B.C. 281). It was almost a matter of course that Pyrrhus and his allies beat the Romans; but the latter learned at every fight and profited by their lessons to make the battles costly. Pyrrhus was glad to leave Italy proper for Sicily, there to change his enemy, and fight for the Sicilian Greeks against the Carthaginians. When he returned, the Romans, who had strained every nerve to meet him on equal terms, were able to defeat him at Beneventum (B.C. 276), and he left Italy altogether.

The war with King Pyrrhus and the Tarentines [see PYRRHUS] ended in making the Romans masters of the southern part of the peninsula; and in B.C. 265 all Italy, from the Sicilian Straits to the Maera, a river in North Etruria, acknowledged the supremacy of Rome. The constitution, now composed of a balanced aristocracy and democracy, had obtained a firmness and consistency which gave peace at home and power abroad; and Polybius the Greek historian, who was a witness of its working towards the end of the Second Punic War, looked upon it with admiration. The first aqueduct and the first great highroad were begun during this period, namely, the Aqua Claudia and the Via Appia (B.C. 312), and in 272 a second aqueduct, Anio Vetus, was added.

Another great nation, a trading, not a military power, fighting by mercenaries whom it paid with its colossal gains made by merchandise and traffic, had grown up on Mediterranean shores. This was Carthage, on the north coast of Africa—a city of Phœnician origin and of Semitic race. In descent, custom, language, and all else the two cities

were antagonistic; and whereas Rome loved, as yet, a closely knit state, Carthage extended her sway over large and distant colonies, the chief of which were Spain and Sicily. This involved a knowledge of naval warfare, which the Romans yet had never tried. The Carthaginians started in the contest with ships, with money, and with widespread dominions, the Romans were land soldiers only, poor, and had never moved beyond their own country. The two nations clashed in Sicily, where certain Italian adventurers claimed the help of Rome against the power of Carthage, and Rome, whose jealousy of the great Semitic city had grown to fever-heat, seized the opportunity with eagerness.

The first great war with the Carthaginians, which commenced B.C. 264, led the Romans out of the peninsula, and they gained possession of Sicily and the adjacent islands. Sicily was the first Roman province, in the proper sense of that term. This extension of the Roman dominions to parts beyond the sea being once made, and the Romans having been compelled, in their contest with the Carthaginians, to become a naval power, the native vigour of the Roman character, their military and administrative talent, found full scope in the enlargement of the Roman dominion.

In the article *PUNIC WARS* the three great contests with Carthage are described. The first lasted from 264 B.C. to 241, and is famous for the myth of Regulus and for the fact of the acquisition of Sicily. The second war lasted from 218 B.C. to 202, and is in fact a duel between the famous Hannibal and the city of Rome. The jealousy of Carthage suffered her great champion to be overcome. Had she supported him, instead of basely deserting him, the face of the world would have been changed. The battle of Zama, in B.C. 202, gave Carthage wholly into the power of Rome; but the jealousy of the Romans was such that they could not rest while their rival existed, and on a pretext which conveniently offered itself they attacked Carthage, now defenceless, and razed it to the ground in B.C. 146. The elder Scipio was the conqueror of Hannibal, the younger Scipio was the destroyer of Carthage. If the historic circumstances were such that one of the two cities must perish, we ought not to regret that Rome was victorious. What progress does humanity owe to Carthage? If there had been left to us of Rome nothing but the inscriptions on her tombs, we should have been able from them to reconstruct her civil and military organization, her philosophy and her religion, while the funeral columns of Carthage reveal nothing but a sterile devotion. The heritage left to the world by Carthage is this: the memory of a brilliant commercial success, of a cruel religion, of some bold explorations, a few fragments of voyages, a few agricultural precepts, of which the Latins had no need; and lastly, the honour of having for a century retarded the destinies of Rome, with the heroic example, at their last hour, of an entire people refusing to survive their country.

But in the meanwhile Rome had attacked successfully her neighbour Greece, and dreams of universal dominion filled her people. The Romans had already Greek subjects in South Italy and in Sicily: they now studied Greek literature and endeavoured to have a literature of their own, though feeble indeed are those beginnings. A little disturbance on the Greek coast of the Adriatic permitted the Romans to interfere and to become possessed of the Island of Korkyra (Corcyra) and the city of Epidamnus. When, therefore, Philip of Macedon made alliance with Hannibal during the Second Punic War Rome at once declared war against him, having secured a foothold on the Greek shore. A peace was patched up in 205. But as soon as Carthage had fallen Rome speedily renewed the contest, which her necessities alone had caused her to interrupt. The second Macedonian War began in 200 B.C., and ended in 197 by the complete victory of the Romans over Philip at Kunos-

kephalê (Cynoscephalæ) in Thessaly, followed as it was by one of the most dramatic incidents in the world's history, the proclamation at the Olympic games in 196 by the Consul T. Quinctius Flaminius, that all Greece was free from Macedonian or other domination. Warned by Philip's fate the Greeks hastened to become allies of Rome. As yet Rome had not made up her mind what to do with her new dependency. A third Macedonian War, waged by Rome with Persens, the son of Philip, from 171 to 168, found the Greeks arrayed *en masse* against this foreign tyrant, under their native one; it ended, however, with

complete victory by the Consul L. Æmilius Paulus at Pydna (B.C. 168), and the division of his kingdom into four states, tributary to Rome. Achaia—that is, the Peloponnæus—remained a Roman ally. A revolt in Epeiros was punished by most awful severity; the people were almost exterminated. The end was no nearer. The fourth Macedonian War was waged contemporaneously with the Third Punic War. Macedonia in desperation (B.C. 149), and being subdued in a few months became definitely a Roman province. Achaia, which had hitherto been fairly faithful to Rome, also revolted, and was conquered by L. Mummius in 146, becoming also a province. Athens as yet remained nominally free. The history of these conquests is known to us through a Greek prisoner, Polybius (Polybius), a leading man in the Achaean League, who, being taken to Rome, became friendly with the younger Scipio and others, and wrote a most interesting and valuable history in the Greek language.

Rome was now mistress of Italy, Greece, and Africa (in the narrow sense of the term), and she turned to new fields of conquest in Asia (also using the term in the narrow sense; that is, little more than what we call Asia Minor). Antiochos III. of Syria had interfered in some of the Greek quarrels, and had been defeated by the Consul M. Atilius Labrius, at Thermopylae in B.C. 191. The Romans had at once followed him across the Hellespont in his retreat, and Lucius Scipio thoroughly defeated him on his own ground at Magnesia in B.C. 189, forcing him to give up all his territory west of Mount Taurus. These lands were given to an ally, the King of Pergamos, who

readily became at once a great potentate. Rome gradually increased her hold upon him and his successors, and finally, in B.C. 133, the last king of Pergamos, Attalos, left them his territories by will, and they were formed into the great Roman province of Asia.

Carthage, Macedon, and Syria thus all fell finally into the condition of Roman provinces within a few years. These were highly civilized states, fighting on equal terms for the mastery. Rome had also entered upon her long career of contest with barbarian foes, destined to last for so many centuries, and to prove her downfall at the last. The Gauls of North Italy (Cisalpine Gaul) had taken Rome in B.C. 390. Mindful of this the Romans used their growing power, on the subjugation of the Samnites, to drive their allies, the Gauls, further back. The lands south of the Po were won before the First Punic War, and after its close several advance posts or colonies were thrown across the river. Once freed from the fear of Carthage, Rome put forth all her energies, and by B.C. 191 was mistress of Italian or Cisalpine Gaul right up to the Alps. The new province was filled with Roman settlers, and became really, though not nominally, what it has always since remained, a part of Italy. Spain, once a province of Carthage, nominally fell to Rome under the blows of the greater Scipio during the Second Punic War, and though the resistance of the natives was stubborn the nominal conquest was gradually converted into a real one, the end of the struggle being marked by the capture of Numantia by the younger Scipio in B.C. 133. The conquest of Transalpine Gaul began a little later than that of Spain. The Romans crossed the Alps on their road to Spain, and

assisted their allies, the Greeks of Massalia (now Marseilles), as early as 218. Acquisitions of territory soon followed in the usual Roman fashion, and B.C. 125 saw the formation of that famous Roman province of Southern Gaul which has perpetuated its name in the country of Provence. Twenty years later the Roman dominions extended from Toulouse to Geneva.

Surely this is the most remarkable half century in the world. Such enormous conquests, and conquests as durable as the power which made them, were never made in a like time. To recapitulate, we note that Cisalpine Gaul became a province in B.C. 191, Macedonia in B.C. 148, Achaia in B.C. 146, "Africa" also in B.C. 146, "Asia" in B.C. 133, Spain also in B.C. 133, and Transalpine Gaul (Southern Gaul) in B.C. 125. A slight check to the further extension of dominion was given by the incursions of the vast host of barbarians called Cimbric and Teutones, whose nationality is one of the unsolved puzzles of history. They defeated several Roman commanders, but the Cimbric were utterly destroyed in B.C. 102 by the famous general and consul Gaius Marius at Aquæ Sextimæ (Aix in Provence), and the Teutones at Verceilæ in Cisalpine Gaul in B.C. 101 by Marius and his colleague, the consul Q. Lutatius Catulus.

The condition of the Roman provinces was far worse than that of the Italian allies. These, even where restricted in the franchise, were still somewhat on a level with Rome, as the title of "allies" shows; but the provinces were mere subject states, ruled by viceroys, who had plenary powers, and who exacted a heavy tribute. The province was farmed out, and the mode of managing the national finance was most oppressive to the taxpayers, little productive to the state treasury, and most destructive of public morals. It was in the provinces alone that taxes were paid. It was at Rome that the tax-gatherers were appointed, and at Rome only complaints could be brought against them. It was the interest of the resident Roman citizen that the highest possible rent should be obtained from the provincial tax farmer, and it was the interest of the latter to extort as much as possible from the tax-paying population over and above what he paid into the state treasury. The wealthiest competitor for the farming of the revenue of a province was the most likely of success; he had the means of making himself popular among the venal electors, and once popular with them he was certain of the patronage of the ambitious intriguers for the higher offices of the state.

But the foreign conquests of Rome had changed the character of the people. Wealth had been acquired by individuals to an enormous amount, corruption had invaded the state, and slavery, which in the earlier ages of Rome had existed only in a limited degree, now became a main element of society. The poor complained that they were ground down by military service; that they had no lands to cultivate; that all was engrossed by the rich and the few. Out of these elements arose the agitation of the Gracchi, who perished in attempts to relieve the necessities of the people by stern agrarian measures (B.C. 133 and 123).

Marius was a man of the people, who rose almost from the ranks, acquiring renown first in the wars of Numidia, leading home the King Jugurtha in triumph B.C. 106, and then in the victory against the Cimbric and Teutones, as mentioned above, in B.C. 102 and 101. When the Social War broke out (*socii*, allies), as an expression of the discontent of the Italians at their many grievances (B.C. 90), Marius, as chief man in the state, was commander. One of his officers in the Jugurthian War was Lucius Cornelius Sulla, an aristocrat of the aristocrats, who speedily showed enormous talent, and rose to a popularity rivaling that of Marius. Sulla had later on brilliantly conquered Mithradates, king of Pontus, the greatest enemy the Romans had encountered since Hanni-

bal, and on his return to Italy in B.C. 83, when Marius was ruling the state with the help of the Samnites and other insurgents, he was at once adopted as their head by the senatorial or aristocratic party. The parties were now definitely formed, their champions at their head. To Sulla, as much the greater man, while equally good as a general, victory speedily fell. With ruthless severity he rooted out the Marian faction, passed a series of laws to secure for ever the rule of the senate and the aristocracy, by virtue of the office he had assumed of perpetual dictator, and then retired into private life after holding his office for two years (81 to 79 B.C.). This is as remarkable a renunciation of supreme power as the world has seen. He died about a year afterwards (B.C. 78), aged sixty years only. Severe as he had been, he was honoured with a public funeral and every mark of mourning, apparently genuine. Sulla changed the face of history more than any single man has done. Undoubtedly through his blotting out the corrupt party of the demagogues in an attempt to exalt the aristocratic influence, at a time when the latter had already become impossible, he precipitated the solution of the great question, and made the establishment of a monarchy only a question of time.

III. With the death of Sulla, B.C. 78, the third period of the history begins. It is short, but crowded with eventful dates. Cnaeus Pompeius (Pompey), a handsome young aristocrat, led one party; Caius Julius Caesar the other. Pompey finished the overthrow of Mithradates, and then passed to the conquest of Syria, taking Jerusalem in B.C. 63, so that Palestine remained a Roman province ever after, governed by vassal kings, the Herods and others. Caesar meanwhile was in Gaul, conquering that vast country between B.C. 58 and 50. He came over to Britain on two voyages of discovery, B.C. 55 and 54, during this period. Matters at Rome meanwhile drew to a close, as before between Sulla and Marius, but the champions were now no longer equal. Pompey was ambitious and popular, Caesar was simply the greatest man who ever lived, a magnificent soldier, one of the most accomplished of writers, and a consummate statesman. Caesar crossed the Rubicon, the little stream technically dividing Italian Gaul from Italy, early in B.C. 49. Pompey, Cato, and Cicero had striven to maintain the aristocratic revival of Sulla by repressing Caesar's power, but the whole state was hopelessly corrupt, the aristocrats did not believe in their cause, and the Roman people was a mere selfish mob. Caesar had resolved to weld Rome together once more by the power of a central authority, not now of a great governing body (as once) of the senate, but by that of one man—himself. All men acknowledged the wisdom of his proposals to end the anarchy of the times. The aristocrats fled to Greece; Caesar followed, and defeated them at Pharsalia, B.C. 48. Pompey fled to Egypt, where he was murdered. Caesar, pursuing him, conquered Egypt and Asia, and subsequently Africa and Spain also, crushing out all aristocratic opposition, and bringing the whole civilized world under his own rule, in about three years only.

This really begins the fourth period of Roman history, the period of the Empire. For although Caesar legalized his authority by taking the title of Dictator, and although for many years the forms of the republic continued under him and his successors, yet the world was clearly under a master all the time. Soon Caesar took the title of Imperator (Emperor), a military title giving power of life and death and martial law; and other powers, all of them well-known under the republic, were conferred upon him, so that the various offices being concentrated in his own person he became a king, and more than a king, while still nominally only a private citizen, highly distinguished and honoured. His splendid plans, and his remarkable achievements towards them in the few months he had to live, are

recounted in the article *CÆSAR*; the assassin's dagger cut all short on the Ides of March, B.C. 44.

Down to the period of the Punic wars Rome had not extended beyond the walls of Servius Tullius; but, after the overthrow of Carthage had constituted her mistress of the world, the city rapidly increased. The wall was almost everywhere demolished to make room for new buildings, so that even in the time of Augustus it was no longer an easy matter to determine its former position, and new quarters now sprang up on all sides. Speculation in houses was extensively carried on, and it was by this means that the Triumvir Crassus, among others, amassed his fortune; for rents were high, and the houses of a slight and inexpensive construction. These *insulae*, or blocks of houses erected for hire, contrasted strikingly with the *domus*, or palaces of the wealthy, which were fitted up with the utmost magnificence and luxury. Thus, for example, the tribune Clodius, the well-known opponent of Cicero, purchased his house for the sum of 14,800,600 sesterces (*i.e.* about £130,525). During the last century B.C. the city began to assume an aspect more worthy of its proud dignity as capital of the civilized world. The streets, hitherto unpaved, were now converted into the massive lava causeways which are still visible on many of the ancient roads (*e.g.* Via Appia). The highest ambition of the opulent nobles was to perpetuate their names by the erection of imposing public buildings. Thus in 181 M. Porcius Cato erected the first court of judicature (Basilica Porcia) in the Forum, and others followed his example. Pompey was the founder of the first theatre in stone. Generally, however, the structures of the republic were far inferior to those of the imperial epoch, and owing to this circumstance but few of the former have been preserved (Tabularium, of B.C. 78, tombs of Bibulus and Cæcilia Metella, &c.).

Caius Julius Caesar is always reckoned the first of the "twelve Cæsars," but the definite and permanent organization of the empire he had founded is due to his great-nephew Octavianus, whom he had adopted, being heirless, as a son. Brutus and Cassius, leaders of the assassins of Caesar, headed the senatorial party, Mark Antony and Octavian headed the imperial party. Joining Lepidus to them because of his wealth they formed the famous triumvirate. Brutus and Cassius were defeated and perished at Philippi, B.C. 42, fought in Macedonia. Mark Antony and Octavian, disregarding Lepidus, divided the imperial rule between them; but the former fell under the witchery of Cleopatra, queen of Egypt, and became an easy prey to the crafty cool Octavian. The battle of Actium (Action), near the Ambrakian Gulf on the west coast of Greece (B.C. 31), left the latter master of the world. Egypt became a Roman province.

Augustus was the new name conferred upon Octavian (B.C. 27). Prince was his chief official title (*Princeps Senatus*, leader of the senate); as Imperator he had the death power, as Tribune the power of veto, the Imperium Proconsulare made him supreme in the provinces, and so on. Following his great-nephew's lead in everything, he avoided touching the forms of the republic. Consuls were elected yearly, prætors, tribunes, ædiles, &c., appointed, and the authority of the senate was nominally held supreme. No regal state was attempted, and most of the great aristocrats lived in richer style than the all-powerful emperor. Under the successors of Augustus the comitia for the election of magistrates no longer existed; the elections were transferred to the senate. The legislative power of the comitia was indeed occasionally exercised, even after the reign of Tiberius; but it fell into disuse, and new laws were either enacted by the senate, or proceeded from the sole pleasures of the chief of the state, the princeps, or, as we are accustomed to call him, the emperor. The first Emperor of Rome was Caius Julius

Date of Accession.

Cæsar Octavianus, whom we generally call Augustus, and who began to reign alone B.C. 27; the last, if we are to include the whole series who bore the name, was Francis II. of Germany, who gave up the empire A.D. 1806. But this last was the degenerate successor of the long line of the Holy Roman Empire, beginning with Charles the Great in 800 A.D. The emperors of Rome must in fairness be held to finish with Romulus Augustulus in A.D. 476, though the sovereigns of the Eastern Empire, commonly called the Byzantine (also the Greek) Empire, styling themselves Roman emperors, continued to reign till 1453, since which time the disastrous rule of the Ottoman Turk has cursed the fairest lands in Europe.

IV. *The Roman Empire* (A.D. 27-476).—These vast dominions bequeathed to Rome by Julius Cæsar and organized into one polity by Augustus and his great successor Tiberius (Rome's most capable administrator), lasted almost unchanged for just 500 years. Britain was almost the only durable addition made to Cæsar's empire. From Augustus onward the Roman government was unwilling to advance the frontiers. This policy was, of course, flexible. Client-princes might have to be abolished, and their kingdoms incorporated under direct government. Different frontiers might require different treatment. Different reigns and ministers had different views, just as Augustus himself let drop the Dictator's plans of further conquest. Now and then an emperor might carry the eagles a long way forward. Claudius sent them into Britain; Trajan revived the old spirit of conquest, and added Mesopotamia to the empire; but Domitian held Agricola back, and Hadrian gave up the conquests of his predecessor. Indeed, had Agricola conquered Ireland and northern Scotland, as he purposed, and would have done but for Domitian's jealousy, it would have been well for Britain and the empire too. Again, had the provinces of Mauretaniam and Sarmatia, gained by Marcus Aurelius, been firmly held, a grand frontier line against Huns and Saxons would have probably sufficed to stave off that ruin of the empire which threw the world into a thousand years of darkness. However, the one broad fact remains, that the empire was completed by Julius Cæsar, and the single Map we give of the Roman Empire serves for almost the whole five centuries of the empire's existence. Its boundaries were roughly the Rhine, the Danube, the Euphrates, and the African deserts; and its peoples were mainly classable as the Latin, the Greek, and the Oriental provinces—the two latter divided by Mount Taurus.

A few broadly distinguished periods mark out the empire, and between them large spaces of time almost devoid of interest recur. There is an entire absence of that continuity of interest which the marvellous growth and development of the republic unceasingly affords to generation after generation of students. The cursory survey which the limits of the present work alone make possible will be best begun by a list of the whole series of emperors, which will be followed up by a brief reference to each of the salient periods just spoken of.

LIST OF THE ROMAN EMPERORS.

Date of Accession. B.C.	THE CÆSARS.	Date of Accession. A.D. THE FIVE GOOD EMPERORS.
48	Caius Julius Cæsar.	96 Nerva.
27	Augustus.	98 Trajan.
A.D.		117 Hadrian.
11	Tiberius.	135 Antoninus Pius.
37	Cæsar (Caligula).	161 Marcus Aurelius.
41	Claudius.	
54	Nero.	180 Commodus.
		193 Pertinax.
68	Galba.	193 Didius Julianus.
69	Otho and Vitellius.	
	THE FLAVIANS.	193 Septimius Severus.
69	Vespasian.	211 Caracalla.
79	Titus.	
81	Domitian	217 Macrinus.
		218 Elagabalus (Heliogabalus)

222 Alexander Severus.	337 Constantine II., Constantinus, and Constans.
235 Maxi.	
237 Gordian I. and II.	
238 Papien us, Balbus, G III.	360 Julian ("the Apostate").
244 Philip the Arabian.	363 Jovian.
249 Decius.	364 Valentinian I. (& Valens)
251 Gallus, Vidusian.	— the Empire divided.
253 Emilian, Valerian.	367 Valentinian & Gratian.
260 Gallienus.	375 Gratian & Valentinian II.
	392 Theodosius, sole emperor
268 (Claudius (II.)	— the Empire reunited.
270 Aurelian.	
275 Tacitus.	395 Honorius (and Arcadius)
276 Florian, Probus.	— the Empire divided.
282 Carus.	425 Valentinian III.
283 Carinus and Numerian.	455 Petronius Maximus, Avitus.
284 Diocletian and (286)	457 Majorian.
Maximian with him.	461 Liberius Severus.
306 Constantius Chlorus, Maximian, Maxentius, Licinius, Severus, Galerius, and Constantine (the Great).	467 Anthemius.
	472 Olybrius.
	473 Glycerius.
	474 Julius Nepos.
	475 Romulus Augustulus.
	476 End of the Empire — Odoacer, king of Italy.
323 Constantine rules alone.	

It was greatly owing to the prudence of Augustus that the empire was so durably founded. For though he was a fairly skilful general, and kept up a large standing army, placing his authority thereby on a firm military basis, he renounced all his great-nucle's plans, gave Rome her first spell of quiet for many long years, improved the administration, increased comfortable living, embellished the city. He was one of the most popular rulers who ever lived. Over and over again he sought to retire, and there is every reason to believe he was genuine in his wish; but the memories of the civil wars were fresh, wounds were yet bleeding or sorely healed over, and the entire nation implored him to remain. The buildings of Rome under Augustus take the first rank of importance among the ruins of to-day. The Pantheon and the Baths of Agrippa, the theatre of Marcellus, the tomb of Augustus, the Basilica Julia, the Forum of Augustus and Temple of Mars, the temples of Julius Cæsar, of Castor and Pollux, of Concord, &c., are still traceable by their remains. It was proverbial that Augustus "found Rome of brick and left it of marble." The great poets, Virgil, Horace, and Ovid, the historian Livy, &c., made also an "Augustan age" in literature. These arts were all imitative of Greek models, but it was imitation of the highest excellence.

The adopted son and successor of Augustus was not a Cæsar but a Claudius by birth. This was the famous Tiberius, one of the most maligned men of all history, whose work and character are elsewhere discussed. [See TIBERIUS.] He was a greater administrator than Augustus, and the empire flourished and grew consolidated under his firm, severe hands. Great German advances were made, but Tiberius (himself, as a younger man, a German conqueror) saw their folly, and sternly checked them. The successors of Tiberius—the madman Caius, the good-natured old antiquary and pedant Claudius, the blood-stained Nero—were Cæsar by maternal descent, and all came to violent ends. Caius was murdered by his guards, Claudius was poisoned by his infamous wife Agrippina, Nero was deposed by the senate, and when the troops advanced to seize him, died by his own hand. It speaks volumes for the work of Augustus and Tiberius that it should have stood the strain of a Caius and a Nero. Details of these reigns are given in the separate articles.

After Nero's death a time of confusion followed. Augustus had set up a military monarchy, ruling by his army; incapable successors had brought it about that the army ruled alone. Each body of troops wished to elect its

own favourite; Galba, Otho, Vitellius, each reigned a short time, and each perished by violence.

But in the year 69 a new start was made. Titus Flavius Vespasianus, a sturdy, plain soldier, was raised to the throne. He insisted upon good order, and the time of the Flavian emperors was a happy period for the empire. Vespasian's son, Titus, subdued the Jews, long in revolt, and the arch of Titus records the conquest, with pictures of his triumph, the sacred utensils of the Temple being carried on the shoulders of the legionaries. Titus was called "the delight of mankind," and certainly was excellent both as a man and a ruler. A phrase of his, that "he thought he had wasted a day in which he had not done at least one good deed," marks his high standard of conduct. His brother and successor, Domitian, was beyond praise as an administrator, but he grew very tyrannical in his later years, and eventually roused a tempest of hatred which culminated in his murder. It was in his reign that the conquest of Britain, begun under Claudius, was actually accomplished by Agricola. These twelve sovereigns (counting Julius Cæsar in) are known to history as the "twelve Cæsars," a somewhat absurd title, but one consecrated by long usage. Their traces left among the ruined architecture of Rome are majestic. Caligula bridged the Forum from the Palatine to the Capitol, and raised huge walls, 100 feet high, to make a level platform for a huge palace on the Palatine, overlooking the palace of the Vestal Virgins and the Forum. Nero outdid this madness by covering the north-western slope of the Palatine, the intervening valley, and the opposite hill of the Esquiline with a huge "Golden House," containing vast gardens, lakes, artificial rivers, race-courses, &c., and sprawling over countless acres. It was never finished, and the politic Flavians, sprung from the people, used all this splendour for the people's benefit, building the mighty Colosseum and the baths and triumphal arch of Titus out of Nero's materials, and on the site he had wasted; and besides this, erecting a magnificent set of public state rooms on the Palatine, which yet afford us the most perfect example of an ancient basilica or law court. The superb Temple of Vespasian and the Forum (now lost) bearing his name and containing the Temple of Peace, mark this time.

The tyranny of Domitian bore different fruit from the mad cruelties of Nero, for his administrative capability left the state in a well-ordered condition. Consequently the succeeding century marks the greatest well-being of the Roman state. The excellent Nerva was elected Domitian's successor, and he adopted and trained the Spaniard Trajan. Trajan in like manner adopted and trained Hadrian, who did the like by Antoninus Pius, and he the like by the grandest and noblest exemplar of the ancient world, the saintly Marcus Aurelius. Each of these men grew up in the austere court of his imperial adoptive father, working from early dawn till late, living a life of hard toil, few pleasures, incessant watchfulness and care, enriched by lofty philosophical contemplation and abstruse studies in his scanty leisure hours. For large tracts of the world this second century, under the "good emperors," marks the high-water mark of prosperity. Contrast Asia Minor, Syria, Egypt, &c., in their then flourishing, well-governed, thickly-peopled condition, with the anarchy of to-day. It is to feel a sense of pity and of waste, of personal loss, and even of dread for our own future lest the precious gift of our high civilization also should perish equally with that, slipping from the grasp of mankind. Hadrian visited every province of the empire to assure himself of the good government of these distant lands. These sovereigns also have left their mark on Rome. Trajan's magnificent Forum, with his column and the arch whose plunder made up the arch of Constantine; Nerva's Forum, with its rich fragment of colonnade;

Hadrian's tomb (St. Angelo), his mighty race-course and palace on the Palatine, his splendid double temple of Venus and Roma along the line of the Via Sacra, the column and pulchre of Marcus Aurelius (now but a vast heap, the "Monte Citorio," where the present parliament house is built), and his noble equestrian statue on the Capitol, once gilt all over, are magnificent works, the wonder of our day. The architecture of Trajan is considered usually to be the highest point attained by the Romans.

Marcus Aurelius had to fight hard (cruel fate for one who so worshipped peace) against barbarian encroachments, and the long prosperity began to show signs of breaking. He died also the character of his son Commodus (his own son, not merely adopted as a successor), and long kept him out of the government. His fears were too true. The noble father's restraining influence once withdrawn, Commodus became for vice and cruelty one of the worst princes who ever reigned, and richly earned his murder in 192. Now came a century as full of disaster as the previous century had been of prosperity. Inrushes of barbarians, pestilences, famines, civil wars, &c., combined to shatter the golden age of the Antonines. The soldiers set up emperors as they chose. The only firm point is the period of Septimius Severus, whose fine arch (though its style is no longer that of the Flavians or the Antonines) yet adorns the Forum. It at least gave Rome a respite of order amid the chaos, from 193 to 211, though it was only enforced by the spears of the legionaries, and disappeared under his brutal son Caracalla. At this time Roman citizenship was granted to all the subjects of the empire, and many foreigners or "barbarians" rose to the imperial power, as Trajan by exception had done long before. Some of the best of these came from Illyr. Claudius (II.) and Aurelian may be noticed as specimens of these, nobly trying to do their duty. Claudius drove back the Goths, and Aurelian conquered the rising Oriental kingdom of Palmyra in a brilliant campaign. It was he, too, who surrounded the city with a solid wall, which yet stands almost intact. (The baths of Caracalla should also be mentioned as a colossal work of this period.)

Another of these able Illyrian princes, Diocletian, came to the throne in 284, and he brought the empire once more under for a time. He in fact reorganized the whole system, making permanent what had gradually been coming forward, namely the habit of no longer regarding Rome as the necessary centre of government, but rather of keeping near the frontiers so as to guard them better. He associated Maximian with himself as joint emperor, and each emperor took a "Caesar" or vice-emperor to assist him; the divisions being (1) Greek provinces ruled by Diocletian from Nikomedea in Asia Minor; (2) Oriental provinces; (3) Italy, ruled by Maximian from Milan; (4) Gaul, Spain, and Britain, ruled from Trier or York. In 306 Diocletian abdicated and retired to that enormous palace which he built at Spalatro, and which is a marvel to this day. The gigantic baths he built at Rome yet stand also in great part. As a result, however, of the changes he brought about, the population of Rome, variously computed at from 2,000,000 to 5,000,000 at the beginning of the second century, and gradually lessening ever since, dwindled under Diocletian to barely three quarters of a million.

A series of civil wars followed, during one time of which as many as six emperors were claiming supreme power. Finally, the last great change was made by Constantine the Great, who became sole emperor in 323, after conquering all his rivals, for he declared Christianity to be the favoured religion of the state, though paganism was yet to be freely tolerated. Indeed, just before his death he himself, long professedly a Christian by conviction, was actually baptized. Now, to estimate the importance of this change, it must

he remarked that before Constantine, the better the emperor—the harder he strove to return to the republican glories of the past—the more sure was he to be a bitter opponent of the Christians. Diocletian himself, though indeed he did not personally order their persecution, permitted his colleague Galerius to treat them with great severity. The Christian and pagan views of life were so different that to a really noble pagan Christianity meant disorder and opposition to good government. Constantine's father, Constantius Chlorus, who had reigned in Britain under Diocletian, had come to know the Christians better, and was a good friend to them, though never joining their ranks. Besides becoming Christian, Constantine the Great removed the seat of empire to the "New Rome" which he founded at Byzantium (Byzantium), and which mankind preferred to rebaptize in his honour as Constantinople.

V. *Decay*.—The foundation of Constantinople by Constantine (in 328) forms the last important epoch in the history of the empire. Though Constantinople had, by its act, become the capital, Rome still retained supremacy over the western portion. After the death of the elder Theodosius (395) the division into the Eastern and Western empires became permanent: the two parts, however, were intended to form one whole. The line of demarcation between the two empires was the Danube from a little above Pesth down to it receives the Drina, then the same river Drinus (Drīno), and a line drawn past the town of Sentai towards the great Syrtis, near the coast of Cyrenaica. All the countries east of this line belonged to the Eastern Empire, and those west of it to the Western Empire. The capitals, Rome and Constantinople, had each its emperor and its senate, with equal privileges; but the bond of union between the two empires was weakened by the course of events, and they soon began to feel jealous of each other. The emperors of the East continued to avert the invasions of the barbarians, who turned their attention to the West, which, being also more exposed to such invasions, was destined to fall first; the Eastern Empire, which had the advantage of a more favourable position for its capital, and had also greater means and better armies, prolonged its existence for many centuries. And even after it had lost all its provinces and was confined to a very narrow space, it nevertheless maintained itself until the year 1453, when Constantinople was taken by the Turks under Mohammed II.

In the fourth century the cultivation of the Roman Campagna began to be seriously neglected, and in an official document of the year 395 it is stated that upwards of 500 square miles of arable land had been abandoned and converted into morass. The malaria at the same time extended its baneful sway from the coast into the interior of the country. The storms of the barbarian eruptions greatly aggravated the misery. Although the Vandals and Goths are often erroneously held responsible for the destruction of all the great monuments of antiquity, which, on the contrary, Theodoric the Great did his utmost to protect, Rome doubtless suffered terribly from having been the scene of their battles and pillagings. In 410 the city was plundered by the West Goths under Alaric, and in 455 by the Vandals.

VI. *Holy Roman Empire*.—After the death of Valentinian III., in 455, there was a succession of emperors on the throne of the West, mere puppets, until 476, when Odoacer, a Goth, chief of the Heruli, assumed the government of Italy, and fixed his residence at Ravenna. He did not take the name of king, but professed to administer the affairs of Italy in the name of Zeno, emperor of the East, as his exarch or viceroy. In 493 Theodoric, a chief of the East Goths, deprived Odoacer of his power, put him to death, and, as Theodoric the Great, became king of Italy. This was the beginning of the Gothic dynasty in Italy, which lasted under Theodoric and

his successors until the kingdom of Italy was recovered by the Emperor Justinian's general, Belisarius. In 537 Rome sustained its first siege from the Goths under Vitiges. They laid waste the Campagna and cut off all the supplies of water brought to the city by the aqueducts; but the skill of Belisarius, and the strength of the walls, particularly those of the Castle of St. Angelo (Mausoleum of Hadrian), effectually repelled their attacks on the city. In March, 538, they were at length compelled to abandon their designs, after having beleaguered the city for upwards of a year. In December, 546, Totilas, the king of the Goths, entered Rome, and is said to have found not more than 500 persons within the walls of the devastated city. Belisarius then repaired the walls which had been partially destroyed, and in 547 he sustained a second siege. In 549 the city again fell into the hands of Totilas, but in 552 it was recaptured by Narsès (who had replaced Belisarius), on account of the mean jealousy of the ungrateful Justinian, and again united with the Byzantine Empire. From this time Rome and Italy were under the government of exarchs, who resided at Ravenna. The Lombards or Lombards were now settled in Italy; and though they never got possession of all the peninsula, like the Goths, they were a formidable nation; and during the two centuries that their power lasted they attacked Rome several times, but unsuccessfully. In 774 Desiderius, the last Lombard king, surrendered to Charles the Great, and the kingdom of Italy passed under the dominion of the Franks. Before the overthrow of Desiderius the dominion of the exarchs had been reduced to insignificant limits by the encroachment of the Lombard kings; and Pepin, the father of Charles, had given the exarchate, with Ravenna, to the see of Rome. Charles the Great confirmed Pepin's gift, and Pope Leo III. crowned him at Rome as Emperor of the West. Rome was under the Carolingian dynasty until 887. In 850 Pope Leo IV. encircled the Leonine city (the Vatican suburb) with a wall, still traceable; but this glimmer of prosperity soon fades under the continual ravages of the Saracens, who now gained a strong foothold in Italy.

A characteristic of this period is to be found in the numerous many-storied towers of red brick which contrast so strongly with the monuments of ancient Rome. This style of architecture was developed in the Carolingian epoch, although most of these towers now extant were erected before the twelfth or thirteenth century. In still greater numbers sprang up towers of a defensive character, a few only of which, such as the so-called *Torre di Nona*, are still preserved. A forest of towers, belonging to numerous different owners, which reared themselves over the ruins of the mistress of the world, affords at the same time a clue to the character of the whole epoch; for, in spite of the nominal sway exercised over the greater part of Europe by the pope and the emperor, continual feuds raged both at Rome and elsewhere between the temporal and spiritual powers, and between the nobility and the populace. The great monuments of antiquity were now doomed to almost utter destruction.

On the deposition in 887 of Charles the Fat, the last emperor of the Carolingian dynasty, there were several competitors for the possession of Italy, and a period of anarchy followed. In 961 Otto I., the German, was crowned King of Italy at Milan, and afterwards as Emperor of Rome by Pope John XII. He swore to respect the authority of the Roman see, and not to encroach upon its temporal power and possessions. He was acknowledged as emperor, and his son as king, by the Romans, but the Pope remained lord of the Roman duchy as an imperial feudatory, just as in the time of Charlemagne. Rome continued to pay allegiance, real or nominal, to the kings of Germany and Italy from 961 to 1278. In 1277 Cardinal Orsini, being elected pope, and having assumed the name of Nicholas III., applied to Rudolph of

Hapsburg, king of Germany, to define by charter the States of the Church, and separate them for ever from those dependent on the empire. He sent him at the same time copies of the former charters of donation, real or supposed, of his imperial predecessors. Rudolph, engrossed with German affairs, and little acquainted with those of Italy, wishing also to oblige the Pope, from whom he expected the imperial crown, defined by letters patent, dated May, 1278, the States of the Church as extending from Radicofani to Ceprano on the frontiers of Naples, and from the Mediterranean to the Adriatic, including the former duchy of Spoleto, the March of Ancona, and the Romagna, and releasing the people of all these places from their oath of allegiance to the empire.

VII. *Papal Rome*.—Thus ended the former imperial authority over Rome and its territory, and from that time to 1870 Rome and the States of the Church were governed, with but little interruption, by the popes. In mediæval times the city was so turbulent, and frequently so dangerous, that the popes readily fell in with the intrigues of the King of France, and transferred the papal see to that country. From Clement V. (1309) to Gregory XI. the popes reigned at Avignon. At Rome, meanwhile, revolution succeeded revolution, among them the most noteworthy being that of Cola di Rienzi, who, in 1347, succeeded in restoring the ancient republican form of government for a brief period. At this time Rome could not muster 20,000 souls, so miserable was her state. The return of Gregory XI. in 1377 brought new life to the city, and a taste for art and literature began to revive later on, under the wise rule of Nicholas V., one of the best of the popes. At the beginning of the sixteenth century the vigorous Julius II. gave Rome new power, and the cultured Medici Pope, Leo X., gave it new glory; the great Church of St. Peter's, the Vatican, &c., arising at this time, and Michelangelo and Raffaele creating the grand period of art. In 1527 Rome suffered terribly under the siege by the undisciplined soldiery of the Constable de Bourbon, but it gradually recovered from the blow, and by the pontificate of Sixtus V. (1585-90) it was able to put on the features which chiefly characterize it at this day.

Under the auspices of Napoleon Bonaparte, a republic, on the model of the French Directory, was established at Rome in 1798, and from 1809 to 1814 Rome was in the hands of France. At the last date the Pope was restored. A brief revolution again made Rome a republic in 1849, under Mazzini, but in the following year French bayonets

brought back Pius IX. in spite of a stubborn resistance. It needed a permanent garrison of 15,000 French soldiers to retain the popes at Rome.

The last event of any importance under papal government was the celebrated Œcumenical Council summoned by Pius Ninth (Pius IX.) [See COUNCIL OF THE CHURCH.] Two days after this assembly had pronounced the dogma of the Pope's infallibility war broke out between France and Prussia, and the severe reverses of Napoleon's army caused the withdrawal of those French troops but for whose presence the Pope's temporal power would long before have ceased. The long cherished aspirations of the Italian nation to obtain Rome for their capital were now realized. Impelled by the unanimous and irresistible demands of his people, King Victor Emmanuel ordered his army to cross the papal frontier. He at the same time addressed a somewhat obsequious and conciliatory letter to the Pope, who, however, was by no means mollified, and knowing the end was coming, was not disposed to accept it without a protest. Meanwhile the Italian troops were received with open arms as they marched through the Papal States towards Rome. General Cadorna found the city gates closed against him, but after a cannonade of five hours, on the 20th September, 1870, a breach was made and the troops entered, being received with vociferous cheers for King Victor Emmanuel. Not content with the mere show of popular and moral sanction of his proceedings, the king appealed to the will of the late papal subjects by a plebiscite, which resulted in the union of Rome with Italy as its capital by 133,681 votes against 1507, and General La Marmora at once assumed the government of the city in his sovereign's name. On the 31st December, 1870, the king made his public entry into the new capital of his dominions, being received with unbounded enthusiasm. The official transfer of the capital from Florence to Rome did not take place until the 1st July, 1871. On the 2nd the king again entered the city in state amidst festivities and rejoicings which were kept up for several days in succession.

Liberal measures were adopted for the maintenance of the spiritual dignity and independence of the Pope, who however, kept closely within the precincts of the Vatican, where he preferred to regard himself as the prisoner of a sacrilegious usurper—a policy in which he was followed by his successor, Leo XIII., even when Victor Emmanuel's death and the accession of King Humbert gave an opportunity of reconciliation.

